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December 1989

48120

An Air Age Publication

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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EXCLUSIVE: BRITISH INT'L JET FLY

SOARING & HELIS At The NATS

FLYING WING SAILPLANE

CONSTRUCTION: P-40 Trainer

Make A FREE Fuel Pump!

F&B: JET SPORT HAWK EXTRA 230 ARF

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DECEMBER 1989 VOLUME 117, NUMBER 12

MODEL AIRPLANE NEWS

ON THE COVER: This month, we show three of the more specialized segments of our R/C sport: helis, fans and gliders. It also captures just how geographically widespread our activities and supply sources are. Up top is the Schluter Jr. 50 heli—a fine machine from Germany; the long line of R/Cers is made up of some participants at the British International Fan Fly; in the center, there's a colorful glider at the U.S. Nats; and at the bottom, you'll see an RAF-marked Sport Hawk breaking ground at the South Manor Flyers' R/C Airport on Long Island. Kodachromes by Dick Tristao, John Lupperger and Rich Uravitch.

FEATURES

CONSTRUCTION

HELICOPTER SECTION

COLUMNS

DEPARTMENTS

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Editorial

by RICH URAVITCH

AMAZING THING, THIS magazine business! As I write, Halloween is a month away; you'll be reading this as Thanksgiving approaches; and the date on the cover would make you think it's a Christmas issue!

Since I've managed to accept the concept of thinking months in advance, New Year is just around the corner, and it's time for some retrospection (which we'll do more of next month) and some game planning. We've accomplished a lot this past year, most of which you seem happy with. We'll talk more about that later, but I want to get a head start on *next* year.

Call me the perennial optimist, but I'd like to make 1990 the "Year of Participation." Involvement is the key to the growth of any activity; ours is certainly no exception, so we'd like to involve you readers more by giving you a way to exchange information. Our "Reader Reports" feature, which allows you to voice your opinions on the various products being brought to the marketplace, has been well received, but we'd like to see even more participation.

Along similar lines, we'll be starting a feature that we'll call "Fliers Photos." Its sole purpose is to provide a regular spot in *MAN* where you can show off *your* newest or favorite model. Just a picture and a description—that's all it takes! Imagine the bragging rights at the next club meeting! How about (as the clincher) waving *MAN* around in front of your wife while pointing out a picture of your model in this *internationally circulated* magazine? What about your kids' pride as they proudly show your airplane to their friends! So, maybe it *won't* have *exactly* that effect, but it's still a kick to see the results of your efforts in print. Start sending in those photos and descriptions; we want to start right away!

We have more of these "participation" programs planned, including a special issue on "Kitbashing" in which you can become involved. I'll talk more about them in upcoming issues. In the meantime, think "Fliers Photos." ■

MODEL AIRPLANE NEWS
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Airwaves

WHERE TO WRITE TO US

If you're writing to the editors (and we'd love to hear from you), please be sure to address your letters to "Airwaves" *Model Airplane News*, 251 Danbury Road, Wilton, CT 06897. Only subscription orders and inquiries are handled by our Customer Service Department in Mount Morris, IL; other mail addressed there must be forwarded to Connecticut, and this leads to long delays.

Watts & Water

I read about the Jomar speed control in your magazine, but I can't find the company's address or a hobby shop that handles this unit. I fly nothing but electric; I'm into "floaters," like my Seamaster 40 with a Cobalt 40 G and modified wingspan.

I'm building a PBY-5A with a 6-foot wingspan and retracts, powered by two Cobalt 40 direct drives. I need a speed control to handle both Cobalts running off of 42 1700mAh batteries, with 21 cells for each motor.

I've built four Great Planes Electric Cubs: two for myself and two for other "gas-guzzler" pilots. Mine is powered by a Cobalt geared 05 with a 12x8 prop, but I put ailerons on the last one using a torque-rod arrangement. Flies beautifully; just finished it last week.

RON BEASLEY
Ottumwa, IA

Ron, Ace R/C probably thanks you, Astro Flight probably thanks you, Great Planes probably thanks you, but the cell manufacturers definitely owe you for purchasing all those cells!! We, of course, thank you for writing and will thank you even more when you send us an update on your electric Catalina. Jomar's address is 2028 Knightsbridge Dr., Cincinnati, OH 45244. RAU

Humming Heli Hunt

I recently bought your July '89 issue, and I love it! On page 70, I saw a picture of an electric helicopter called the Honey Bee. Is it really hard to fly? If it is, can you recommend a good electric plane that's easy to fly, and, if available, water floats? A low price would also be nice. Thanks!

CORY CHECHILE
Heraldsburg, CA

Cory, our Heli Challenge ace, Craig Hath, will be talking more about the Honey Bee in a future issue. I've heard that, because of its diminutive size, the little heli can be difficult to handle, but that can be said of nearly any heli if you have no previous experience. In the meantime, check out last month's issue for some help in selecting a good electric, and stay with us, because interest in electrics is growing so quickly that we didn't have enough space to include Field & Bench Reviews on all the other kits that may be of interest to you. Advice we give to you, as well as to any new flier, is to check with your local hobby shop dealer and find the local club. They should be able to provide valuable information and, perhaps, even instruction. RAU

Vocabulary Expansion

A lot of newcomers to the hobby (including me) don't understand many of the terms used in your articles. It would be nice if you'd include a glossary of the most commonly used terms.

MILES LEE
Port Orange, FL

Good point, Miles. We did exactly that in the September issue, in our helicopter section. A lot of the basic terms, like CG, airfoils, roll, pitch and yaw are common and apply to both fixed and rotary wing. We'll try to accommodate your request in future issues. RAU

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Airwaves

(Continued from page 8)

Younger Yearnings

I'm 14 years old, and I've been reading your magazine for a little over a year. I've found *MAN* very informative, and through it, I've purchased my first R/C airplane—a Carl Goldberg Electra. I would, however, like to make a suggestion: Have you ever thought of putting a list of clubs in *MAN?* I know the list could be pretty long, but how about it?

There are some other things I'd also like to know. I know a ducted fan shouldn't really be a second plane for me, but has anyone designed and built a B-52 or B-58? Also, has anyone at least designed a true jet engine made for R/C planes? Finally, have you ever thought of devoting an issue to electric flight?

JOSHUA TAPP
Arlington, TX

You know, Josh, for a 14-year-old, you have a lot of intelligent questions. You also have great taste in R/C magazines. To list all the clubs in MAN would take a tremendous amount of space, and I'm not really sure all the readers would be thrilled to see a zillion lines of type and a table of contents. However, I think if you drop a line to the AMA (1810 Samuel Morse Dr., Reston, VA 22090) and tell them you'd like to find out what clubs are in your area, they might be able to help you. Another great source that might even be quicker is your local hobby shop, where a lot of the club members are sure to hang out.

No one, to my knowledge, has built and successfully flown an R/C B-52 or B-58 Hustler. I know both projects have been considered, but the closest I can remember seeing was a B-52 at the Southwest Fan Fly in Seguin, TX, about six years ago. It didn't run, taxi, or even move, and the company that was supposed to produce it has long since departed.

There are at least three successfully run, true jet (turbine) engines in existence. Two of them have flown, and one of those in the U.S. Their application for R/C use has been demonstrated, but I have some real safety concerns about their use by the average modeler. It's difficult enough, at present, to convince modelers of the value of doing a post-flight inspection of their models, including checking their propellers for knicks or damage.

How then would you stress the importance of performing turbine-blade or "hot section" inspections? What about the specialized equipment required? Failure of any of these components can produce catastrophic results if it comes apart at 85,000rpm. Their widespread availability is probably still a long way off, and I breathe more easily because of it.

Hope you enjoyed our "electrifying" November issue!! RAU

Perfectly Polish

I apologize for any mistakes that occur in my writing, but I'm relatively new to English-speaking Canada. Model Airplane News is one of the best (if not the best) publications for *aero modelers* I've seen so far. When I came to Canada from Poland, I was pleasantly surprised by the number of magazines dealing with *aeromodeling*. Even more surprising was that they all claimed to be the "world's leading" or "best" magazine in that field. So I went to the local newsstand, picked out one issue of each magazine (MAN wasn't part of the selection), read them all, settled for one and was happy with it—until I later came upon an issue of MAN. Boy, had I been missing some great stuff! Since then, I've bought every issue of your outstanding magazine and recently became a subscriber.

Now to my question. Can I participate in American fly-ins and contests without being a member of the AMA (I do belong to AMA's Canadian counterpart, MAAC)? I'm a 14-year-old beginner and

am just starting my first scale project. Can you tell me of an iron-on covering material that's not glossy and can be painted with plastic model enamel. And, since it must be fuel-proofed, what kind of a fuel-proofer should I use to get a matt finish?

I'm intrigued by the popularity of the PZL 104 Wilga (an outstanding small airplane that comes from the country of my birth), and I'd like to give your readers some additional information about it. In addition to the Canadian paint scheme, many other schemes can be used. There's the Polish civilian scheme, a Russian civilian scheme, an Indonesian scheme, even a Polish military scheme (some of those airplanes are used for "behind-the-lines" duties, such as carrying packages and personnel)—a classic military aircraft lover's dream. The top and side surfaces are a mixture of khaki and earth brown; the underside is light blue. The plane was flown to the World and European Precision Flying Championship by the Polish team for the last five or six years. Anybody who'd like more information about this or other Polish airplanes can contact me, and I'll do my best to share all I know.

PETER GALUSZEWSKI
101 White Oaks Court, Apt. 705, Whitby Ontario, Canada LIP 1A1

Peter, Your question concerning participation in contests and fun flys in the U.S. is an excellent one for which we didn't have an answer. We posed it to Mike Woodfolk, membership director of the AMA, and he told us that because of the variables in insurance coverage in different countries and present lack of a reciprocal arrangements, members of MAAC alone may not participate in AMA-sanctioned events. They may, however, obtain "affiliate member" status in the AMA for $10 per year (Oct. 1 through Sept. 30), and this will allow them to participate.

All the iron-on fabric-type materials like Coverite, Solartex and similar products aren't glossy, can be painted with a variety of products and then fuel-proofed with clear polyurethane or epoxy. Many of the Mylar plastic coverings will accept paint if properly prepared, scuffed and primed prior to color application.

Thanks for volunteering to help other modelers with their Wilga projects. I'm sure it will be appreciated. RAU

Hello! Denmark is Calling!!

I'd like to reach R/C Clubs and R/C fliers all over the U.S. who are interested in flying R/C aircraft and who would like to correspond and perhaps exchange visits. I'm a member of the Copenhagen R/C club "Comet" (see enclosed photo of members). Yours truly is second from the left, leaning on a black and orange WIK Charly.

I've been subscribing to *MAN* for more than two years and think it's a great magazine.

PETER ANDERSON
Medelbyvej 54, 261o Rodovre, Denmark

There you go Europe-bound R/Cers. A chance to enjoy beautiful Scandinavia and get in some flying while your wife bolsters the Danish economy. RAU

VTOL U.

I'm a freshman mechanical engineering major in Florida and an avid R/C enthusiast. The VTOL Harrier, especially the McDonnell Douglas AV-8, is one of my favorite aircraft, and I've thought often of designing and constructing one capable of vertical takeoff and VIFFing (Vectoring In Forward Flight). The problem is two-fold: Would such a model require a thrust-to-weight ratio greater than 1:1, or would ground effect be adequate along with certain aerodynamic effects? Second, is a ducted-fan (or fans) capable of providing the needed thrust, or would I have to wait for the development of a low-cost, practical turbine engine suitable for use in an

(Continued on page 12)

Airwaves

(Continued from page 11)

R/C plane? I've studied in detail the power and control configuration of the AV-8 and dare to say that it would be feasible to recreate it for R/C.

Finally, does a ducted fan have the ability to provide thrust when the entire airflow isn't in a straight line, as would be the case? Would tail-pipe velocity be adequate? Just some ideas I had. Thank you.

TARIQ RASHID
Tallahassee, FL

Tariq, A big portion of the engineering challenge of duplicating the VTOL qualities of the Harrier has been met by Mike Koskelka whose Harrier is shown in this issue, hovering at the British Fan Fly. A 1:1 thrust/weight ratio might be barely adequate as the key requirement is to lift a static mass of a given weight vertically, even considering the value of ground effect. As far as the turbine goes, see my answer to Joshua. The ducted fan, like its full-scale brother, the turbo fan, can certainly provide thrust in other than a straight exit. Models, as well as full-scale jets, can use bifurcated inlet and exhaust systems, but it must be recognized that when airflow is diverted or redirected, there are thrust losses as a result of duct drag. Good luck; in four years you'll probably be providing the answers rather than asking the questions. RAU

Fox Fan

I recently had a problem with a Fox motor, so I sent it to "Duke" for repair. The motor was repaired: sleeve, piston, wristpin and rod were replaced. They test-ran the engine and returned it to me—*no charge!*—and within a week!

This man, Duke Fox, is a legend in the model world. We all owe him a big "thank you."

JACK AUSTIN
Midwest City,OK

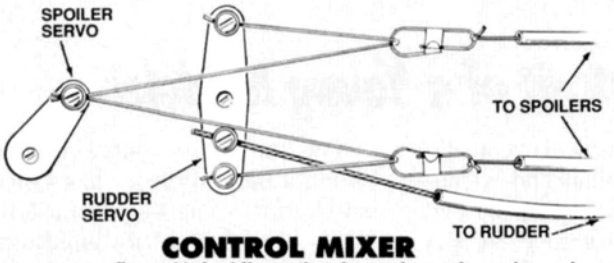
No doubt about it, Jack! Here's ours: Thanks, Duke!

RAU

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News**, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and length.

Hints & Kinks

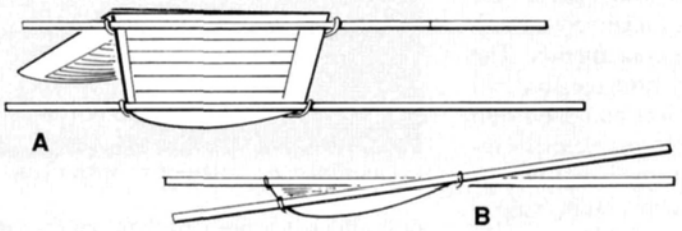
by JIM NEWMAN



CONTROL MIXER

This mixer is especially suitable for differential spoilers, and it avoids complex mechanical devices. Dacron threads are clamped to the spoiler servo arm with a regular Du-Bro or CG pushrod connector. The lines are then run through U-control or fishing-line connectors and back to the rudder servo arm. (Very small split rings can be used instead of U-control connectors.) The flexible cable or Nyrod rudder pushrod is attached to the appropriate side of the rudder servo arm.

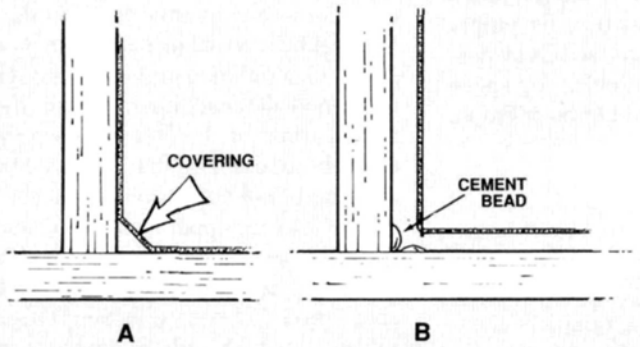
Matt Freund, Mesa, AZ



WARP CHECKING

Quickly check wings for warps by inverting them across a suitable support and then taping sticks across the wing at the root and tip. (You could use rubber bands instead of tape.) If the wing is *not* warped, the sticks look parallel as in the first diagram (A), but if it *is* warped, it will look like the one in the exaggerated sketch (B). Corrective action with a MonoKote gun will quickly have you in the air. Incidentally, the heat gun also works on a doped wing.

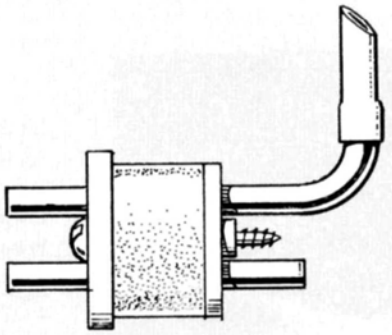
Fred Mulholland, Tampa, FL



DOPED COVERING PULL-AWAY

Lovers of silk or tissue-and-dope fanatics might run into this problem, and the answer is quite simple. When using butyrate dope, which shrinks appreciably and pulls away the covering from corners as in drawing A, try coating the corner with regular cellulose cement first; allow it to dry, apply a bead or two of cement along the corners as in drawing B, then quickly rub the covering material into it. The cement forms a much stronger bond between the corner and the covering.

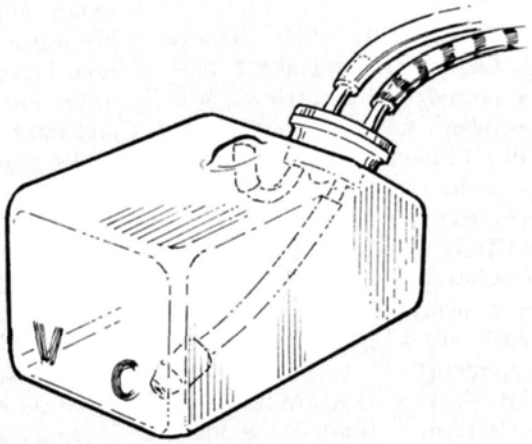
Ray Gareau, Ville De Laval, Quebec, Canada



FLEXIBLE VENT PIPE

Some plastic fuel tanks have a small blister on top, and when the vent pipe is bent up to fit into it, it can be extremely difficult to push the stopper/pipe assembly through the tank opening. The trick is to keep the brass vent pipe short and add a piece of silicone-rubber fuel line to the end to make up the length. Now the vent will flex as it enters the tank's stopper opening.

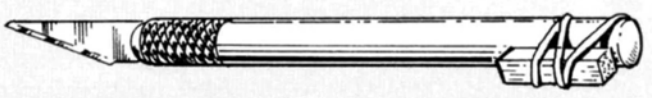
Robert Peterson, Youngstown, NY



FUEL-LINE IDENTIFIERS

When the tank, stopper and fuel lines are ready for insertion into the tank bay, using a permanent marker, mark the carburetor fuel line with stripes and also write the letters "V "(for vent) and "C" (for carburetor) on the rear wall of the tank, opposite the appropriate lines. When you later have to replace the lines, the marks will tell you which tube is which.

H.E. Stiver, Hawkes Bay, New Zealand

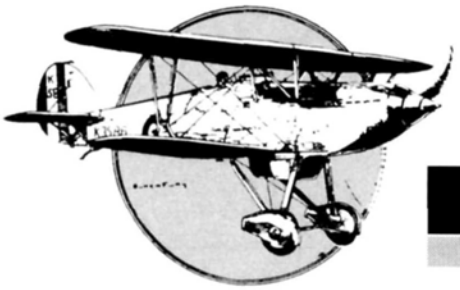


ROLL-RESISTANT KNIFE

A quick way to prevent knives from rolling off the building board: Just rubber-band or tape a short length of balsa (e.g., 3/16 inch square) to the top of the handle as a chock.

Dennis Bryant, Burgess Hill, Sussex, England

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News**, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



Fifty Years Ago

by KATHERINE TOLLIVER

Portrait of a Young Modeler

IT'S DECEMBER, 1939. You're home. Snow swirls around the mailman as he trudges up the driveway with your December issue of *MAN*. (Sure, the $2 cost of a 12-month subscription put a dent in your allowance, but *MAN* is worth it.) Great cover this month: A Burnelli Bomber CB-34 streaks across a fire-red sky; far below, a ship is sinking. You wonder how many bombs the CB-34 can carry. What's the wingspan? And who is this guy Burnelli?

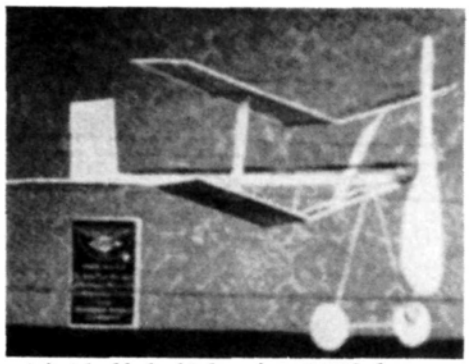
The CB-34 flying wing was the brainchild of Vincent J. Burnelli, "a short, energetic, obstinate engineering visionary" who spent 20 years struggling to get financial backing "to give force to his great mental power." During those 20 years, he never sold one of his planes. Undaunted, the feisty Burnelli eventually secured contracts in England and in Canada, and it was in the Canadian Car and Foundry Company that the CB-34 was born.

Originally a flying wing designed as a 27-passenger airliner, the CB-34 was converted into a fast, heavy bomber for wartime use. It was of complete cantilever wing and cantilever tail-boom construction, and the outer wing panels were built on a twin-spar arrangement of aluminum web-and-strip construction. The ailerons and the main fuselage were all metal, and the wings were equipped with trailing-edge flaps. The complete assembly was a modified Burnelli airfoil section. Three engine mounts were welded to the forward portion of this structure, and three Rolls Royce Merlin, liquid-cooled geared engines supplied the power.

Capable of carrying six tons of bombs, the CB 34's bomb load ran from front to back along the length of the fuselage on opposite sides of the main cabins. With a wingspan of 102 feet, 4 1/2 inches, and a length of 73 feet, 5 inches, its empty weight was 17,690 pounds, and its disposable load was 17,500 pounds. Top speed at sea level was estimated to be 300mph, with an additional 30mph at 6,000 feet. The service ceiling was 26,000 feet, with an absolute ceiling of 30,000 feet. With the aid of special flaps, the landing speed was less than 70mph.

The Grumman U.S. Navy F3F-1 powered by a 650hp Wasp Jr.

You turn to a construction article: "Build a Baby Biplane" has a nice alliterative ring. (You throw in a few more "Bs" — basically, a baby biplane of bamboo and balsa built by beginners—and wonder if the editors at *MAN* might hire you someday.) The plans look simple, and the article even says that the "biplane described here will be welcomed by novice builders."

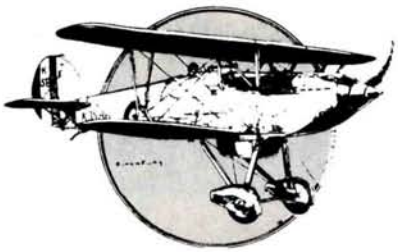


A finished baby biplane from MAN plans.

The cellule is what makes the biplane R-8 a fine flier. In a biplane, there are two centers of aerodynamic force in the cellule that have to balance to ensure normal flight. In addition to providing enough lift to support the machine in the air, the resultant force of the R-8 had to be great enough to overcome the considerable structural drag common to biplanes. The cellule had an upper wing incidence of zero degrees and a lower wing incidence of 6 feet. Stagger was 3/4 inch, and the area was 21 3/16 square inches. This little biplane was built with the goal of surpassing the performance of a conventional monoplane ROG, which had an area of about 24 square inches. You like that baby bipe. With a winder you could store up 800 turns and fly for 3 minutes.

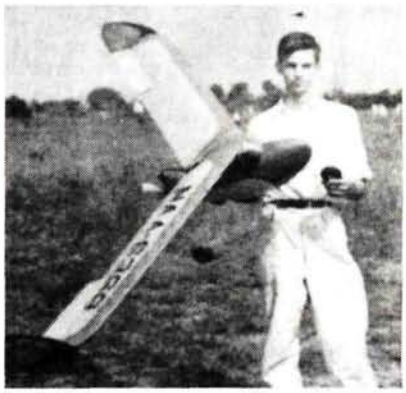
The construction article on the Grumman F3F-1 fighter looks like a real challenge! There are over three pages of diagrams with three-view assembly, engine layouts and cross sections. Because of the

(Continued on page 16)



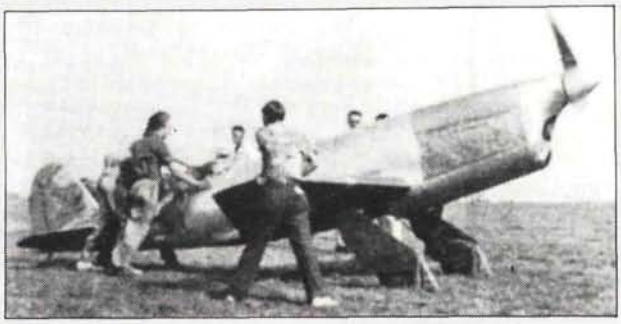
FIFTY YEARS AGO

strength provided by their all-metal fuselages, Grumman airplanes were some of the first to withstand the Navy's new power-dive test. Powered by the 650hp Pratt & Whitney Twin Row Wasp Jr., the F3F-1 was capable of speeds of up to 280mph. These planes could "shoot off the aircraft-carrier deck into the sky like a bullet, roar into a steep climb, and level off with the greatest of ease." LeRoy Grumman and his associates originated the much-copied retracting-wheel system. The rounded fuselage, compact wing arrangements, and folding landing gear made Grumman's planes easy to identify in the sky.



Fred Kulick with an unorthodox, but successful, gas job minus tail.

for *MAN* to confirm reports and to sort fact from propaganda. It was confirmed that the U.S. Army Air Corps had ordered millions of dollars-worth of new planes: North American advanced and basic trainer bombers, Martin twin-engine bombers, and Flying Fortresses were just part of that order. "Flash News" had become war news.



The landing gear on Harry Crosby's racer failed to retract at the National Air Races. The drag reduced his speed by 75mph.

Assembling this Grumman model is very tricky. Although the landing-gear chassis is difficult to assemble, the task isn't considered insurmountable. The tow-drag trusses on each side of the fuselage are another story: "For the less experienced builder, it's suggested that he make no attempt to make this unit." These trusses need to be hinged on pivots and have to move freely in and out of the wheel well if the retracting mechanism is to operate properly. Maybe you'll wait awhile before you build this one!

You notice that the "flash" in the "Flash News" column is beginning to flicker as the war continues to escalate and more and more aviation activities become classified. It's becoming increasingly difficult

You have all twelve issues for 1939, and you like to flip through them periodically. September's issue with the Consolidated 31 on the front did a great job of covering the Nationals. The Bell XP-39 on the July cover brings back fond memories: Your sister went to camp that month.

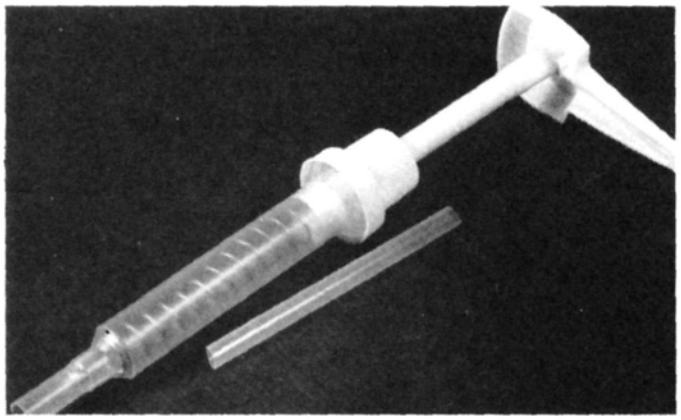
Now you have the decade's final issue. On the last page, there's an ad for a new, 1940 spring catalog: "100 pages, profusely illustrated, scores of gas-powered, rubber-powered and scale model airplanes." Sounds interesting. It's only 5 cents. You watch the snow drifting across your driveway and wonder how long *MAN* will be reporting on the war. ■

How To:

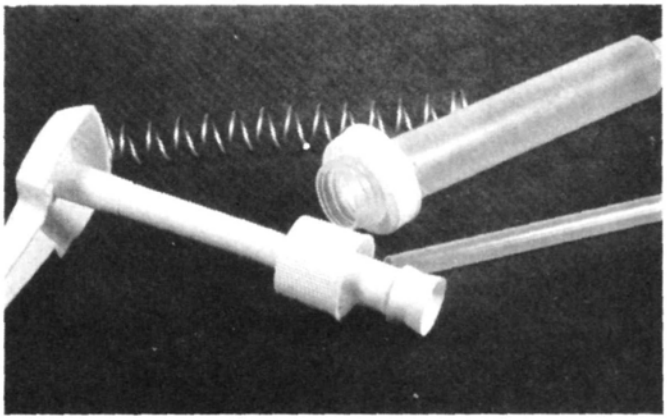
by RANDY RANDOLPH

MAKE A PUMP FOR GLOW FUEL...*Recycled rubbish makes for rapid refueling*

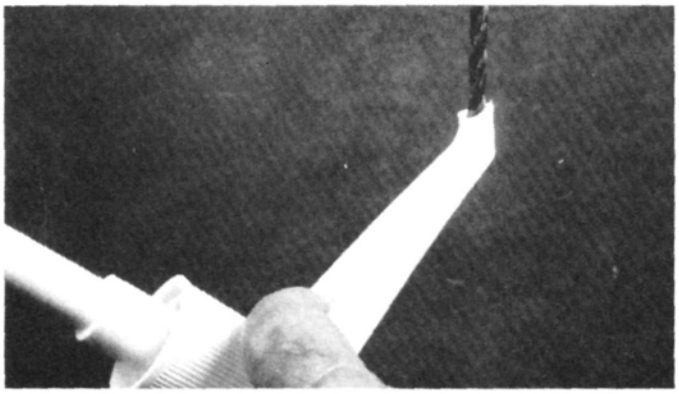
Fuel pumps run the gamut from eye droppers and squirt bottles to electric super-duper ones. This one will outperform them all! It delivers a full ounce of fuel with every pump, lasts indefinitely and costs almost nothing! There's only one drawback: It won't work with gasoline! The photos show the way.



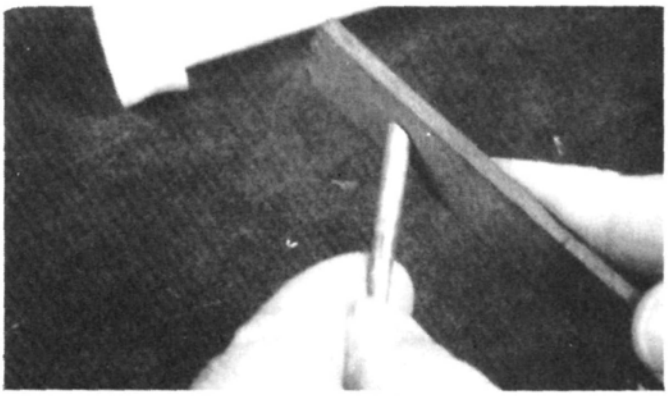
1. Pumps like this are delivered with gallon containers of mustard and catsup to most restaurants and fast-food establishments. They're usually discarded after use and can be had for the asking.



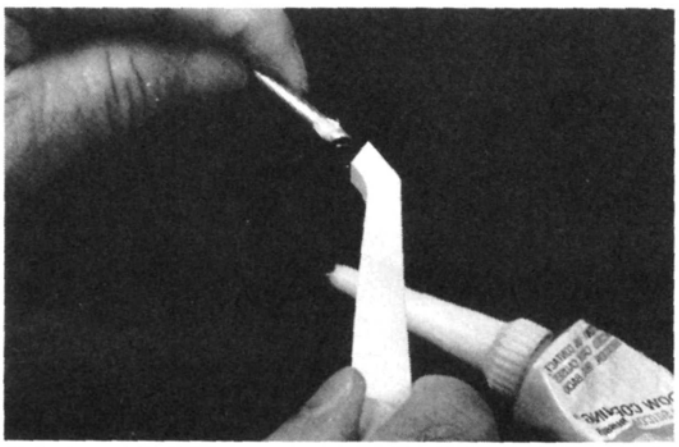
2. First, completely disassemble and clean all the parts with soap and water; then remove the spring and reassemble.



3. Carefully enlarge the hole in the end of the spout with a 1/8-inch drill. Drill the hole approximately 1/4 inch, or into the spout direction change.



4. File one end of a 1 1/2-inch piece of 1/8-inch brass tube to the angle shown. This angle should match the direction change in the spout.



5. Apply a dab of silicone cement around and slightly back from the filed end of the brass tube, then slip it into the enlarged spout. Be sure the filed angle matches the angle of the spout.

6. Adjust the length of the pickup tube to just short of the full depth of the fuel bottle, and screw the pump into the neck; the threads will match. Silicone fuel line and a filter complete the system. The system will deliver fuel faster than the fuel line will accept it, so pump slowly!

CONSTRUCTION

SQUINT SCALE P-40 TOMAHAWK

by TIM FARRELL

Type: *"Squint scale" warbird sport flier*
Span: *62 inches*
Weight: *6 1/2 pounds*
Area: *785 square inches*
Wing Loading: *19 ounces/square foot*
Power Req'd: *.60 (4-stroke); .40 to .45 (2-stroke)*
No. of Channels Req'd: *4*
Materials: *Balsa and ply*

THE P-40 SERIES fighters are possibly the most easily recognized airplanes of WW II, owing, no doubt, to the publicity given to the Flying Tigers in China. During the early days of the conflict in Southeast Asia, these planes bore the brunt of the Japanese advance. To many, any airplane with a shark's mouth painted on its nose was a P-40. While not the equal of the BF-109 or the Zero or, for that matter, any of its contemporaries, it had a reputation as a strong, reliable aircraft. Probably best remembered for its service in the China/Burma/India campaigns, it managed to serve in all theaters of operation during WW II. It was such an all-around "workhorse" fighter that no fewer than 13,700 were produced during the war. Having served with the British, Australian, New Zealand, A.V.G. and the U.S. (some had even found

This is about as close to a quiet, warbird trainer as you're likely to get!

Hard to imagine a fierce-looking P-40 being a "trainer," but this one sure is. Thick wing, good lifting airfoil, and light weight all help.

their way to Russia by the end of the war), the P-40 can claim to be the most widely used fighter of WW II.

As a model, the P-40 has almost ideal proportions: a large wing, good nose and tail moments, and a large fin/stab group. Actually, it makes a better low-wing aileron trainer than many so-called "trainers" of this type. This plane is *not* scale, stand-off scale, or anything close to scale. It *is*, however, a scale-looking trainer that can be handled by anyone who has built and successfully flown a .40 trainer.

The original model is powered by an Enya* .60 4-stroke, and it flies very realistically on that power. It has a large airframe for this size of engine, but lightweight building and covering materials produce a plane that flies well and lands gently. A standard .60 2-stroke would give it rocket-ship performance, but this wasn't my intent for this model. If you need more power, a .90 4-stroke would be a better choice.

Above: Although not scale, the outlines of this P-40 are very good. Lots of interesting paint schemes available, too! Left: Designer Farrell holds his P-40 up to compare it with smiling Lee Henderson's Mustang. Lee is credited with "Squint Scale" name suggestion.

CONSTRUCTION: The construction of this model is very simple, and, as already stated, if you've built a balsa/ply trainer before, you can build this model. Start by cutting out left and right fuselage sides. Add the lite-ply doublers, again remembering to make a left side and a right side. I used Zap-a-Gap* to build 99 percent of this aircraft, and it works very well for both lightness and strength.

When the sides have been assembled, glue formers 1 through 4 to the left fuselage side at a 90-degree angle; then add the right side to the formers, again checking to verify the 90-degree angle. Install the 1/8-inch lite-ply fuel-tank floor, and add the triangular bracing stock to the inside corners of the fire wall/fuel tank floor area. Bring the fuselage sides together at the tail with the piece of ply (F-6; 3/8x3/32 inch) between them. Don't glue yet!

Next, install former F-5 in the correct position, and check the fuselage for straightness. (We don't need no bananas!) When you're satisfied that it's OK, Zap it all together at F-5 and F-6. Add the 3/32-inch cockpit floor and 1/4-inch-square balsa to the inside of the rear fuselage section (top and bottom); then add the 1/4-inch-square fuselage cross "stiffeners." All the upper fuselage formers (F-1A, F-3A, F-30, F-4A and F-5A) can now be added. Glue the 3/8-inch turtle deck (F-7) onto the rear formers, and sand it flush with the formers at the same angle. Add the 1/64-inch ply turtle-deck sides (1/16-inch sheet balsa can be used instead). Glue the 1/4-inch-square center keel between F-1A and F-3A. This area is now sheeted with two pieces of 1/64-inch ply (left and right).

Now for the only tricky part: Mount your engine to the fire wall using a radial mount. Install your nose ring on the back of the spinner backplate with a 1/64-inch ply spacer between the nose ring and the backplate (for spinner-to-airframe clearance); then put soft balsa blocks between F-1 and the spinner nose ring. Be patient and fit carefully; it takes time, but the results are worth it.

Add the top nose block from F-1A forward. Next, using a modeling knife, coarse sandpaper and elbow grease, carve and form the nose to the shape shown on the plan. The gun covers and carb intake shroud are also made of balsa and added after covering. Now do the chin scoop in the same way; hollowing it out is optional, but it makes the P-40 look great.

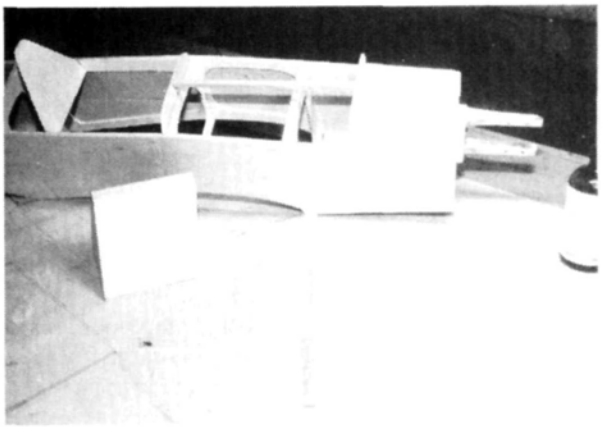
The wing is built flat on the board in the usual way, but make sure your board is flat and smooth. Build left and right panels, and glue them together with one tip blocked up 5 inches to obtain the proper dihedral angle. The airfoil is quite thick, so a conventional aileron/trailing edge stock can't be used. (Sorry!) Instead, sand the aileron/trailing edge from the appropriate size sheet balsa.

If you don't like bellcranks, use strip ailerons like those on your high-wing trainer. The only differences between this wing and your high-wing trainer's is its shape and the added landing-gear blocks!

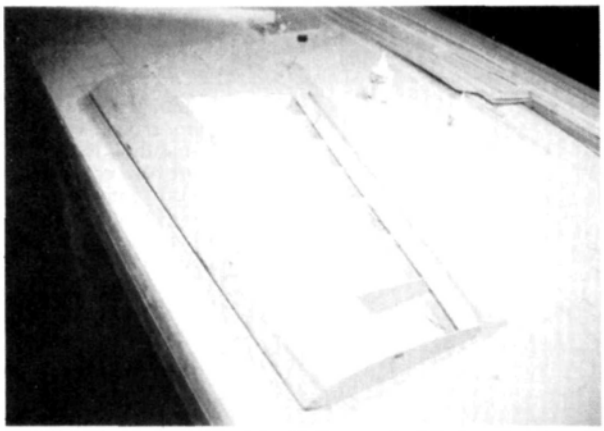
The tail fin and stab are built with 3/8x1/4-inch strips and sheeted with 1/16-inch balsa. The rudder and elevator are built in the same way, but they're covered with MonoKote*. Use a commercially available tail-wheel bracket, and mount it before you glue the

Squint Scale P-40 Tomahawk

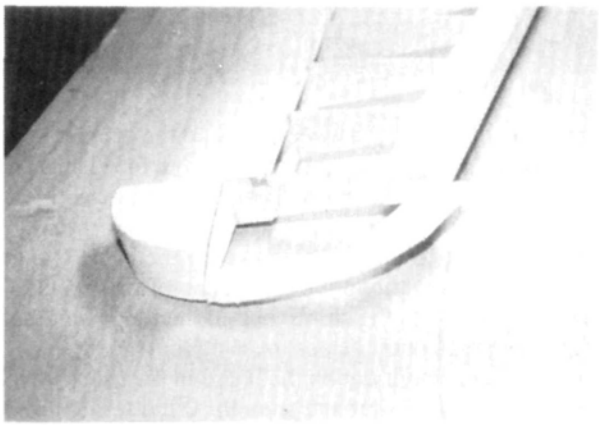
Modified flat-bottom airfoil allows you to build the wing panels right on the board. Hefty twin spars make for a rugged structure.



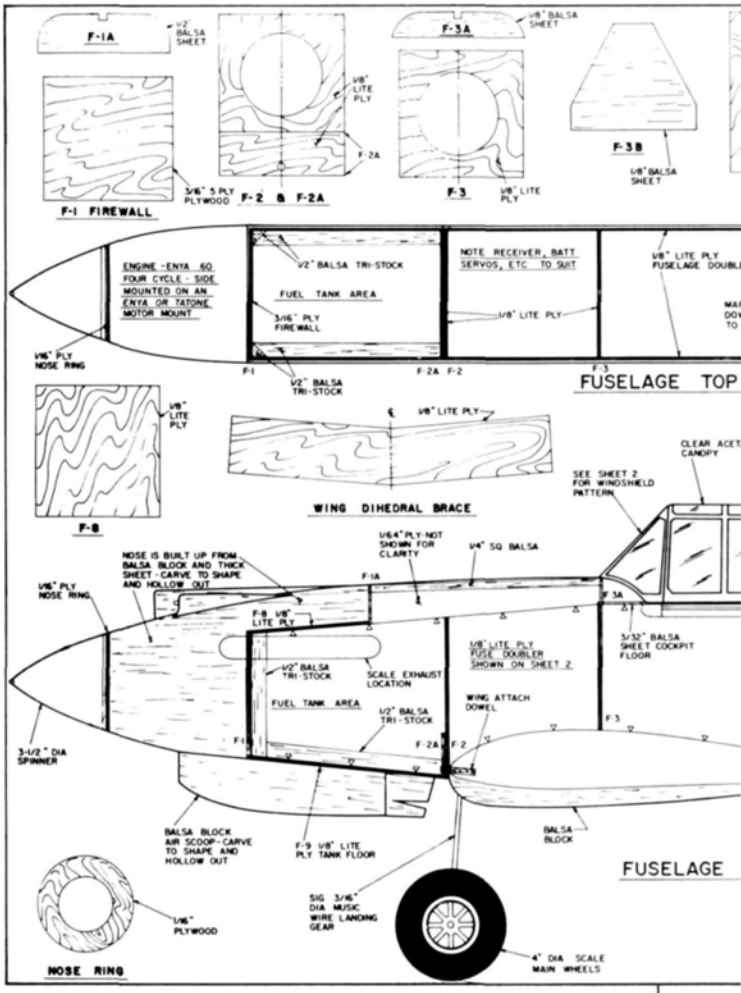
Forward fuselage shows simple yet strong construction. Basic box uses sheet and block balsa to develop characteristic P-40-style contours.



Left-hand wing panel with all the required balsa sheeting in position



Wing tip prior to carving and shaping.



ORDER THE FULL-SIZE PLANS... PAGE 116

rudder into place. Use 1/4x1/4-inch spruce for the elevator and rudder pushrods.

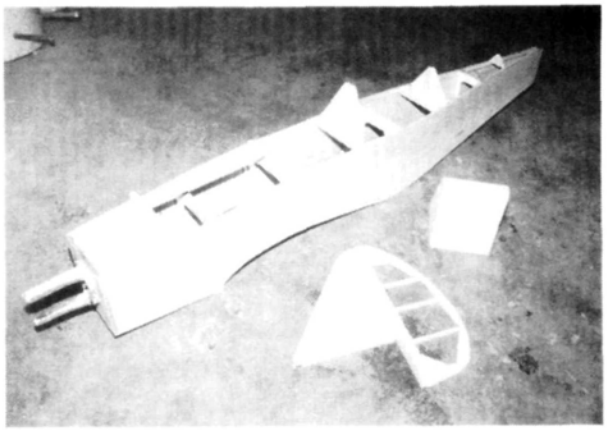
The canopy is simply a bent or formed piece of butyrate—one piece for the windscreen area and another for the "greenhouse." This method allows you to have the canopy open or closed; mine is partly open, and this really adds to the look of the aircraft.

The model was covered with brown, tan and light blue iron-on coverings, and I mixed brands to get the colors I wanted, but I had no problems. I used MonoKote trim sheet for all trim insignia and letters. When the panel lines and airbrushed highlights had been added, the entire model was given a coat of satin urethane.

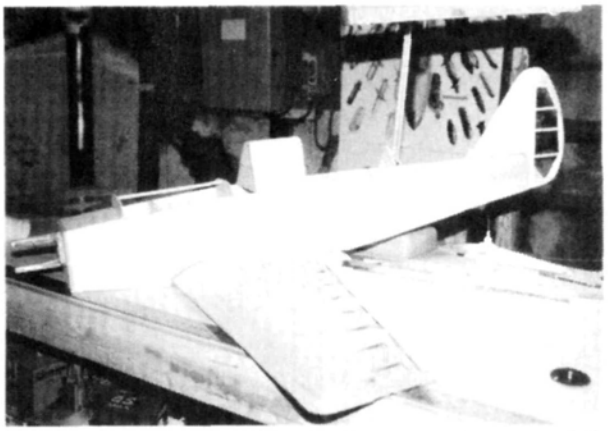
There; you've built your first "almost-scale" ship, and it's just as easy to fly as your high-wing one!

PERFORMANCE: By using the throttle and a suitable large prop (I use a 14x6), you'll have a very aerobatic, quiet model; it will fly so slowly that it doesn't seem possible that it could stay up in the air.

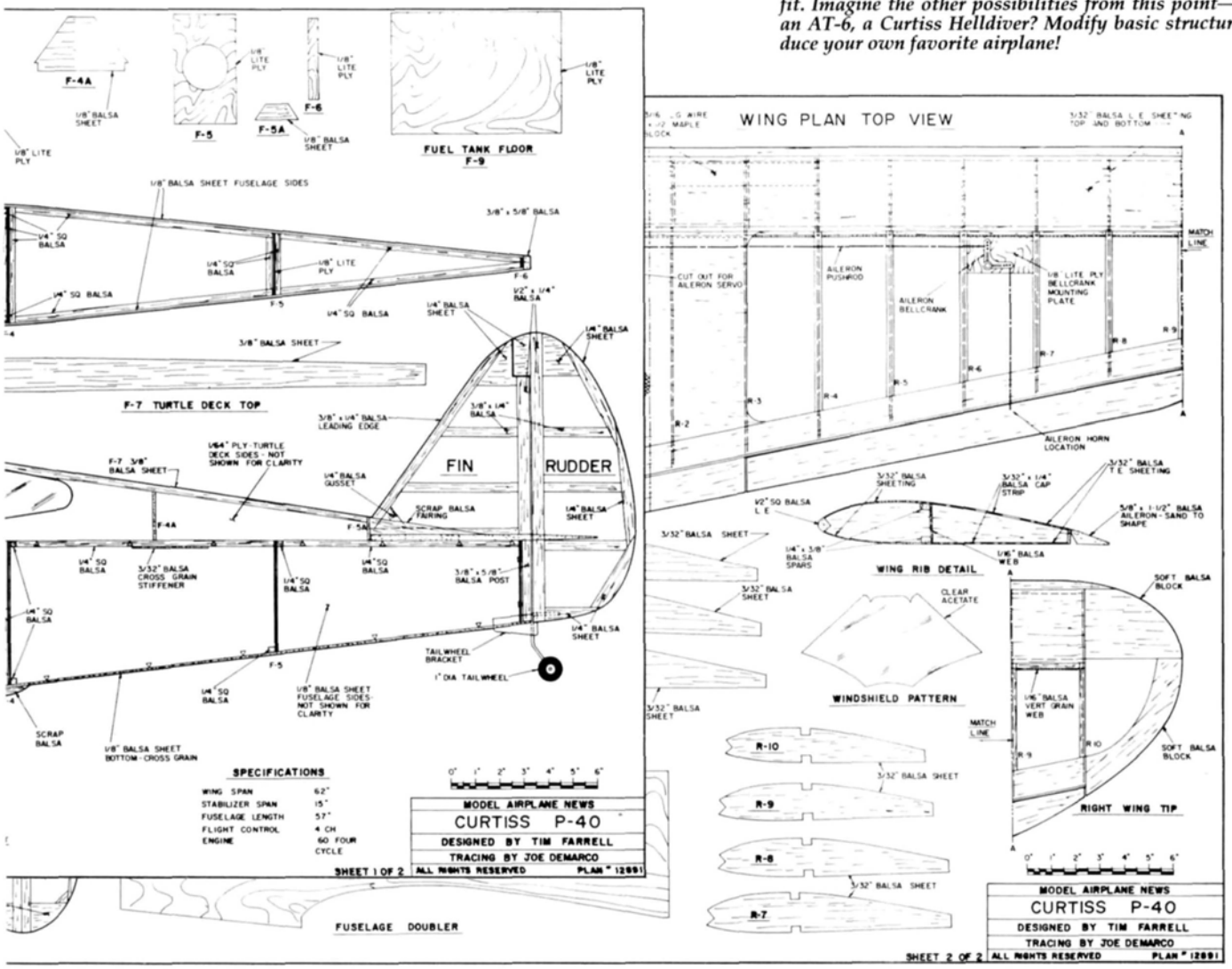
With the .60 4-stroke, it will never fly fast enough to get you into trouble. With this P-40, you definitely fly the *wing*, not the



Basic fuselage before addition of turtle-deck sheeting and cowl. Vertical fin and rudder are of balsa.



Wing temporarily attached to fuselage to verify wing-saddle fit. Imagine the other possibilities from this point—a PT-19, an AT-6, a Curtiss Helldiver? Modify basic structure to produce your own favorite airplane!



throttle! It will do all the basic aerobatics with this power: Loops, rolls, Immelmanns and spins are all possible, and, in this respect, it has an edge over many other trainer-type aircraft. Don't try to force this trainer off the ground. Normal ground roll on grass is about 50 feet. It handles very well for a tail-dragger, and even if this is your first one, you'll have no trouble with it. As with any trainer, ask your club instructor to help you to trim it out, and as long as you've kept everything straight and light, you'll be very satisfied with your model.

With its very easy and forgiving nature and hundreds of great-looking paint schemes, it's a great "trainer scale" aircraft—OK, so I slipped up and called it "scale"! Given that it resembles a P-40 if you stand way, way off, my buddy, Lee Henderson, coined the term "Squint Scale." Regardless of what you call it, it's still a P-40 and perfect for hunting Zeros. Good flying!

**Here are the addresses of the companies mentioned in this article:*
***Enya Model Engines/Altech,** P.O. Box 286, Fords, NJ 08863.*
***Zap-a-Gap;** distributed by Pacer Technology, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*
***MonoKote;** distributed by Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.* ■

Basics of Radio

by RANDY RANDOLPH

Threads and Things

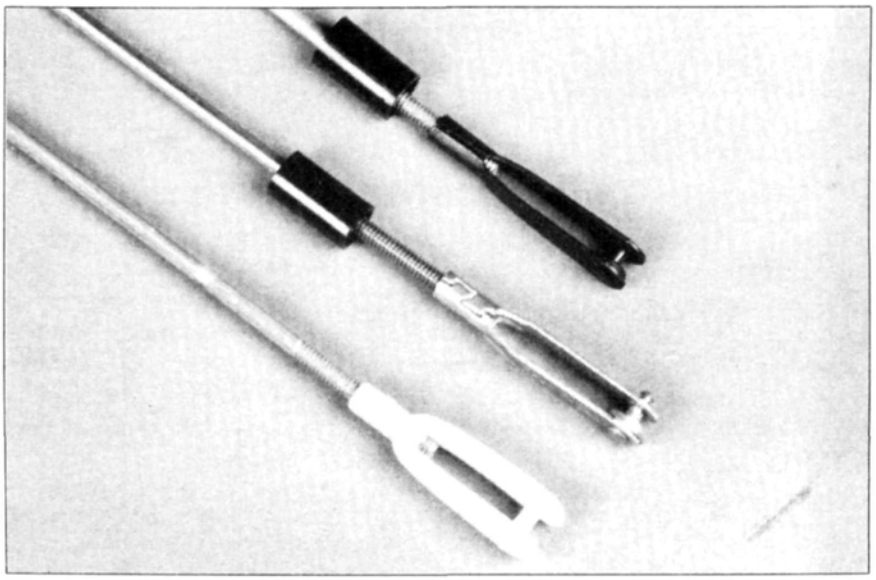
Are all threaded rods created equal?

ELEMENTARY PHYSICS tells us that there are several ways to acquire a mechanical advantage. The lever and the inclined plane are usually the first that spring to mind. As levers are represented by the gear train in our servos, the inclined plane manifests itself as the screws that mount our engines and connect our servos to the surfaces they control. Let's spend a little time looking at the screw, or more to the point, the threads and their associated devices.

Control surfaces can be connected to a servo in a number of ways. Cables that make a closed loop from one servo arm to a horn on one side of the surface, then from a horn on the other side back to the opposite side of the servo are probably the most positive way to transfer servo movement. The cable system works well, but it has some drawbacks. It's difficult to install and adjust, and it's for this reason that the pushrod systems are by far the most popular.

A pushrod with a threaded stud at one end to accept a matching clevis is the most convenient way of transferring servo movement to a control surface. The threads allow the clevis to be screwed in or out—in effect, adjusting the length of the pushrod—to achieve very fine adjustment of the surface. All threads and clevises aren't alike, even though they're machined for 2-56 threads, and the difference is very important!

There are a number of ways to develop threads on a piece of metal, but the two most common that we deal with in pushrod ends are cut threads and rolled threads.



Three clevises. Which two are best? Bet you miss it! (See text.)

Cut threads are made just as the terms implies. The threads are cut into the metal, usually steel wire, with a device called a die that's made for a specific wire size and with a specific number of threads per inch. Metal is removed in a groove that spirals up the wire with the material between these grooves forming the threads. This is the most common way to create threads on a metal rod.

Rolled threads are generated with a tool that presses the grooves in the wire and allows the material to squeeze up on each side to form the threads. No material is removed when threads are rolled on a piece of wire. Rolled threads are stipulated for all full-scale aircraft fittings that require threading.

One of the pictures shows the difference between rolled and cut threads. The rolled threads on the end of the wire on the left are of a larger diameter than the wire, while the cut threads on the wire to the right are of the same diameter as the wire. It's highly recommended that pushrod ends use rolled threads, if possible, especially with larger, high-performance airplanes.

Any discussion of threaded pushrods would be incomplete without mentioning the clevises, which are the reason the threads are there in the first place. Actually, the clevis can be the weakest link in the pushrod-control system. The second picture shows three types of clevis: two that are good and one that isn't so good. Most modelers probably use the one that isn't so good!

Of the three clevises shown, the best two are on the left. The nylon job would be even better and the best of the three if the shoulder hadn't been reduced to look like the other two! The next best is the metal clevis in the center, which has a locked seam that won't open with use.

The clevis on the far right has a straight seam that can open easily. Should this seam open even a little, especially when the pushrod end has cut threads, there's a good chance it will slip under a sudden or

Control

These threaded rods don't look the same, do they? Well, they're not!

unusual load. At best, a trim change would take place and, at worse, the pushrod could pull completely out of the clevis and cause loss of control.

Sudden and unusual loads don't necessarily happen in the air, but, more likely, in everyday handling and trips to and from the field. Any time a control surface is moved by some external force, the load placed on the clevis-pushrod system can be much greater than during flight conditions.

It's an extremely good practice to give all pushrod-clevis joints a dose of thin CA after trim has been established. This is especially true with the use of straight-seam metal clevises. Slip the locking sleeves over all clevises that aren't self-locking.

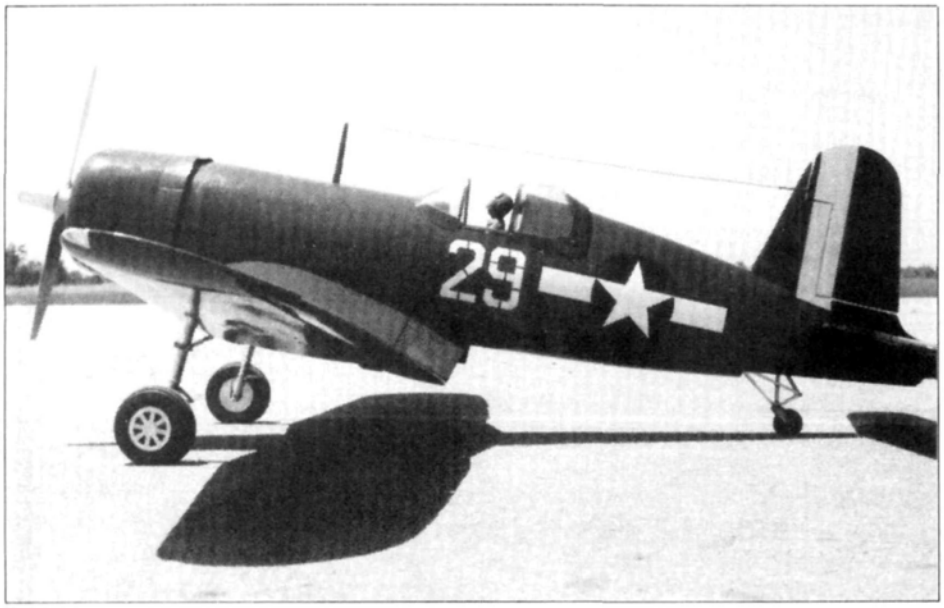
Pushrod ends and clevises are very inexpensive, so use only the best. To eliminate wear in this area, I recommend that you change the clevises and control horns every year. Never use any hardware that has been salvaged from a crash; it may have been the cause!

That really is basic! ■

Sporty Scale Tec

by FRANK TIANO

Modeling the Heavy Metal



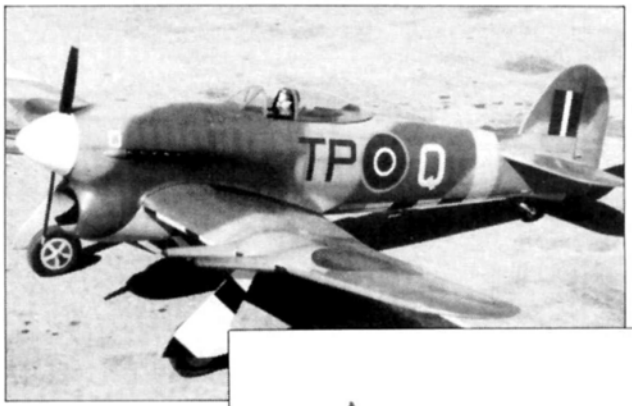
Built by Garland Hamilton from the Bob Holman kit, this F4U Corsair would be competitive at any contest.

I NOW KNOW where the old saying, "feast or phantom" came from. A few issues ago, I wrote something about the slim chances of a scale modeler finding anything new in the way of kits. Yes, I know there are a few new, twin-engine jet jobs floating around (with more expensive price tags than that of the shiny new Toyota you've had your eye on), but I had something a bit more conservative in mind! Anyway, I think I've mentioned how Yellow Aircraft* and Bert Baker were releasing a couple of new kits, but I thought there really wasn't much more on the horizon unless you wanted to build from plans. Boy, was I wrong!

In the last few days, I've received a gaggle of new information from all over the continent. We all know that Bob Holman* offers some great plans, but take a gander at the heavy-metal kits he now sells! All are in the 80-inch, 24-pound class, and in the pictures, they sure look good! The Hellcat looks absolutely real, and it's one of the finest I've ever seen. It looks very much like the work of Garland Hamilton, who is a true craftsman. The Corsair and FW-190A aren't exactly to be sneezed at, either. How about that great Typhoon built by Denny DeWeese? This one's from the Rick Lewis stable, which also includes the massive Skyraider built by Gene Barton. Both models are real gems. The 90-inch, 34-pound 'Raider features scale wing-folding as well as authentic landing gear and struts. Barton Machining is responsible for all the special metalwork, and the scale landing gear and struts definitely make a big difference.

The Skyraider is actually a team project involving five modelers from California. Rick Lewis is the designer and moldmaker for the entire project, and Dennis DeWeese, Gene Barton, Shame Cramer and Diego Lopez are responsible for making the prototype parts, testing the construction methods and sequence and providing Mr. Lewis with enough complaints and whines for the next 36 months! The proof, however, is in the proverbial pudding, and Gino's 'Raider is the first of the five to fly. All reports indicate that the thing is nothing short of superb, and if you're not too hung up on having the wings fold, you can save an extra 4 to 6 pounds.

Mallory Models* has been around a long time, and it's probably best known for its great Laser. This Laser has very accurate outlines and is ideal for any type of flying, whether it's sport or serious competition, and it does well in the turn-around pattern events. The 1,000-square-inch design features an excellent fiber-



Left: Short-nosed FW-190 is another great favorite among fans of the larger-scale Warbirds.

Right: Denny DeWeese's Hawker Typhoon. Although infrequently modeled, it has all the "right numbers"...and just look at the wide stance of that gear. Even Abate couldn't ground loop this one!

glass fuselage and foam wings; it spans 73.5 inches and weighs in at a mere 10 to 13 pounds, ready for fuel. This deluxe kit offers plug-in wings that have been properly engineered, a 6061-T6 aluminum landing gear, a tinted canopy, glass wheel pants, full-size decals and more. Bill Hinnant (Mallory's owner and designer) even customizes each fiberglass fuselage to the brand of engine the modeler will be using. Wouldn't it be nice if more manufacturers did that?

Bill's newest release is a splendid rendition of Lockheed's fabulous P-38 Lightning. This one spans 108 inches and weighs approximately 25 to 30 pounds, depending on engine selection. While the Laser sells for a modest $295, the P-38 goes for slightly more. For $1,295, you receive a fiberglass fuselage pod, twin tail booms (set up for whatever engines you decide to use), glass superchargers, glass radiators, two spinners, an ultra-clear canopy, elevator counterweights, foam wings, all hardware, drawings, plans, etc. Bill even shows you how to make the scale Fowler flaps perfectly operational. Drop Bill a line, or call him in the evenings at 703-765-0041.

This 108-inch P-38 Lightning kit is available from Mallory Models. At 25 to 30 pounds, it features functioning Fowler flaps. Not for the faint of heart!

If all those weren't enough to whet your scale-building appetite, how about a few new plans from Don Smith* down in Boca Raton, FL? Don has been designing for years; in fact, his Curtiss R3C2 racer on floats was on our October seaplane cover. Don has just released plans for a 1/5-scale Sea Fury, a 1/5-scale Nakajima KI-84 Frank a Heinkel He-51A biplane in 1/5 scale and that famous Curtiss racer in both 1/4 and 1/3 scales. I've just finished some of the mold work for the KI-84, and I'm building one for next year's competition circuit. The Frank has an 88-inch span and the plans cost $42; the Hawker Sea Fury is 86 inches and sells for $42; the Heinkel is 90 inches and goes for $34; and the smaller Curtiss sells for $36 and the larger one for $48. These plans are well-done and flight-proven, as well. In fact, Don designed my Pucara, which flew flawlessly—once!

Grumman F6F Hellcat built from the Holman kit. Difficult to tell from the real thing.

Blueprint Blues & Drawing Debacles

Now on to something else. Have you ever heard about a supposed scale design that was drawn directly from factory blueprints but looked only vaguely like the real airplane? Well, there are many reasons why your scale model doesn't look exactly like the one in the magazine ads, or the plans, or the three-view you're using. Some of these problems are caused by builder or designer errors.

For instance, a few years ago, when I was looking for material with which to draw up my Skyraider, a friend in California sent Dave Platt and me a set of factory drawings directly from Douglas. Dave, in his usual dry, British way, casually informed me that he'd be quite surprised "if this bloody thing flew at all!" The wing was drawn on the fuselage *exactly backward!* Now, we know that Douglas didn't build a bunch of Raiders with their wings on backward, but these "factory drawings" are often only for reference. Until the advent of CAD and other

(Continued on page 76)

Gene Barton's daughter, Allison, with her dad's Douglas Skyraider, built from the Rick Lewis kit. First of a group of five to fly. Another warbird that reduces to model size extremely well.

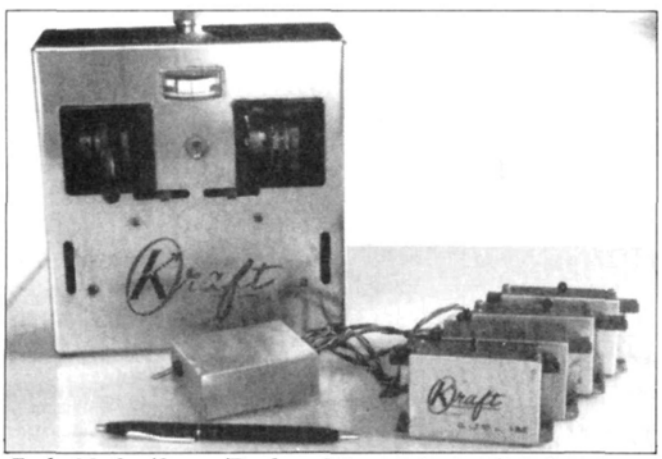
Golden Age of

by HAL "PAPPY" deBOLT

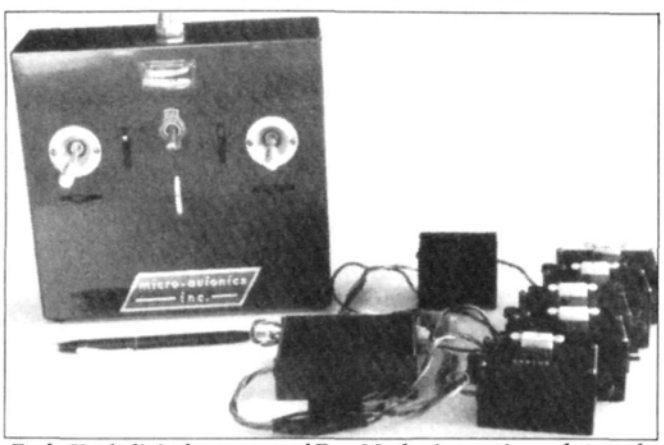
READY FOR ANOTHER history lesson? Having reported at some length on the Bonner Digimite offerings that were probably the origins of today's *commercial* systems, it's time to "fill in the blanks" and discuss the origins of our *present* R/C system.

Remember that R/C began with the use of a single RF signal (a basic radio-wave frequency) that was interrupted by a control code, i.e. single channel. The first improvement on this was the transmission of a separate audio tone over this carrier frequency, and then the interruption of this tone for coding. This increased safety, as the carrier frequency was always there; and it also added the *ability* to have complex coding, which is a basic feature of our modern systems. Still with just a single channel, intricate actuators were devised so that *additional* controls could be operated mechanically: One escapement could then operate a basic control *as well as* a secondary one.

The first step toward electronic multi-controls was the ability to send *several* audio tones over that single carrier frequency; each tone was decoded separately to operate a separate control. The effect was something like having a single-channel system for each desired control. (Each control action was like those that were normal for single channel.) These were labeled "Band Pass," or audio, systems. Walt Good's TTPW system was something like this, but his complex coding "pulsed" the two actuators and offered a rudimentary form of proportional control.



Early Mathes/Spreng/Dunham Micro Avionics digital system. Note bulk. Orbit servos used. (Photo: Dr. M. Shabot.)



Early Kraft digital system used Don Mathes' expertise and started Kraft Systems progress. Compare size with those today. (Photo: Dr. M. Shabot.)

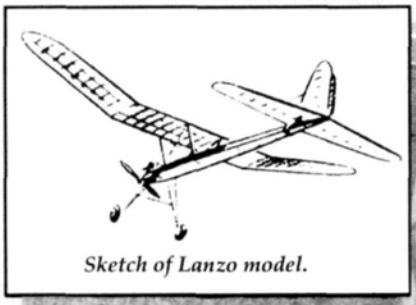
The first widespread use of multi-controls came with the introduction of the "reed" systems. Here again, audio tones were used (as many as 12), and these *weren't coded;* the audio frequencies were simply recognized by a tuned reed discriminator. The major advantage of reeds was that they allowed us to operate much more sophisticated actuators, and their success and reliability did much to promote R/C flying. It wasn't long before all the major manufacturers were producing them.

Reed fliers soon found a way to simulate proportional control action with appropriate transmitter operation, and their flying methods quickly demonstrated the desirability of proportional control. With the value of propo recognized, there was a great deal of behind-the-scenes activity directed toward its development, but efforts were hampered by the necessity of using tubes and dry batteries. Obviously, the transistor and Ni-CD batteries suddenly looked very practical.

Early digital R/C pioneers. Left to right: Cliff Wierick, Maurice Woods, Phil Kraft and Doug Spreng at the first Tournament of Champions in Oklahoma City. Sponsored by Maurice Woods.

Almost simultaneously, two fundamental forms of proportional control were investigated: analog and digital. Analog reached the market first, followed by Bonner's Digimite and, later, digital systems were made by all manufacturers. Basically, analog relied on several audio tones that were varied proportionally in frequency to operate special proportional actuators called "feedback" servos (the forerunners of today's technology). I've described the history of analog systems, and that brings us to the point at which we are now.

As I describe the digital systems (and they seem to be *the ultimate* at this point), it should be interesting to check back and see how this system is, in many ways, a development of what came earlier.



Sketch of Lanzo model.

Chet Lanzo at Valkyries Field, Bradenton, FL, in 1988. Model is his well-known Bomber with Super Cyclone power.

ONE OF MODELING'S best friends died On August 13, 1989. Having enjoyed more than the proverbial "three score years and 10," Chester Lanzo died at his summer home in Valley City, OH. For many years, Chet had spent the winters with us in Florida, and we were good friends.

A pioneer modeler, Chet's modeling activities during his last years exemplify his dedication to the hobby. The day before his death, he was working on an almost-completed replica of the Racer—his 12-foot free-flight plane

His early accomplishments are numerous, especially in rubber-powered flight and FF gas. Many of his designs were published, and other people were as successful with them as he was. Chet won contests ranging from the local level to World Championships, and he has been honored by both the AMA and the Free Flight Halls of Fame—a tribute that shows the great respect his peers have for him and his modeling. Of course, we remember him as the first R/C Nats winner, and we remember his determination: He built his first R/C system by doing research and teaching himself radio theory at the local library. Such dedication!

In his usual, modest, down-to-earth way, Chet attributed much of his success to his early association with Dick Korda. As youngsters, he and Dick were flying buddies in Cleveland, and, with a good-natured rivalry, they built new models *weekly,* hoping that each would be an improvement on the one before. Learning together through the time-honored "cut-and-try" method, they both became accomplished modelers.

During recent years, Chet endured a back problem that surgeons brought under control two years ago. Even while incapacitated, he kept his interest in modeling alive by resurrecting his old designs for use in SAM activities. Once back on his feet, he looked forward to our flying sessions and never missed one! At the field, with a transmitter in his hand once again, his eyes really lit up, and he was always happy to share his know-how and give advice.

Chet was active again and enjoying every minute. Last year, in his mid-70s, he attended the prestigious Wakefield event in England, where he placed respectably. This year, he was off to the FF Champs in Taft, CA, the SAM regional in Illinois and local area meets. Just like old times!

Much credit for Chet's renewed activities must go to his long-time friend, Tom McCoy, and to more recent acquaintances, like Fred Mulholland, of Tampa, FL, who inspired Chet while gaining much from his friendship.

It's sad to report the loss of yet another modeling pioneer: a leader; for many of us, a cherished friend; someone who won't be forgotten. Chet Lanzo's spirit will surely live on through his contributions and the use we make of them. ■

Who Did What?

In the early '60s, the space program provided both lucrative and interesting work that was very exciting to modeler types. Many R/C enthusiasts, e.g., Jerry Pullen, Doug Spreng and Don Mathes, were drawn into the space effort, and while the rest of us were looking for success with available R/C equipment (mostly with reeds), these three were burning the midnight oil searching for ways to adapt the digital propo concept to our needs. They occasionally had something they could fly and would show up with it at local fields. Onlookers were always amazed! Before

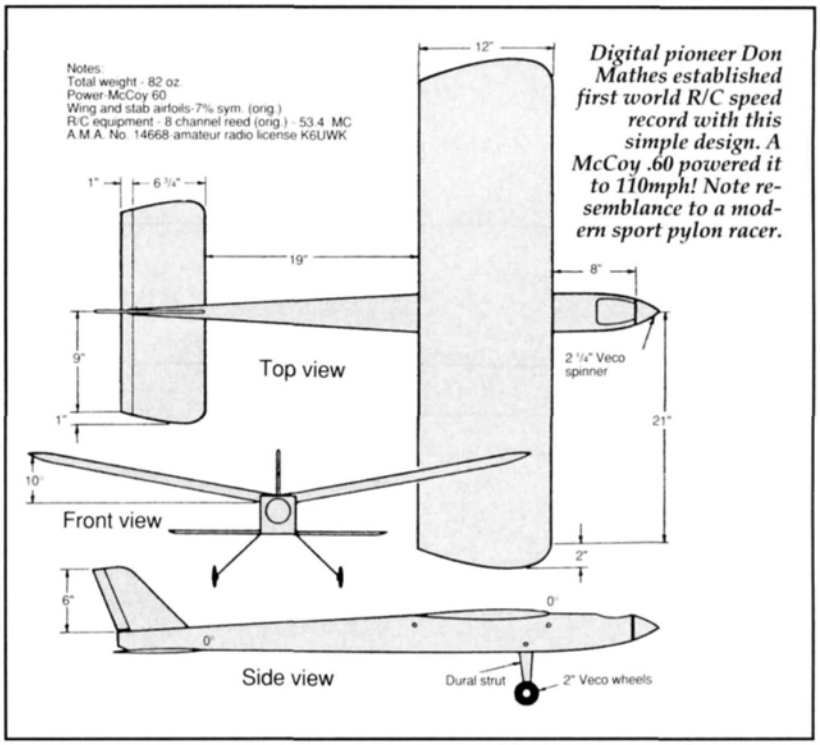
the flying session was over, they usually recognized the need to go back to the drawing board, but their dedication obviously paid off and eventually resulted in the precursor of today's R/C systems.

All three—Jerry, Doug and Don—contributed significantly to the development of digital R/C. The one who stuck with R/C longest and brought its development closest to its present form was Don Mathes, who unfortunately left us all too soon. Don was a talented R/C flier, and in the late '50s, he and buddy Doug Spreng dominated competitions. Don's Bandit and Gambler pattern designs became well-known and were definitely in the forefront of design and flying ability. A couple of Don's designs were published, including the Digester, which was featured in the December '64 issue of *RCM*. With his great interest in electronics and his experience in modeling, he appreciated the needs of R/C very well, and, with Doug Spreng, he established the Digital Control Systems Corp. Competing against the analog systems, their Digicon system showed much merit.

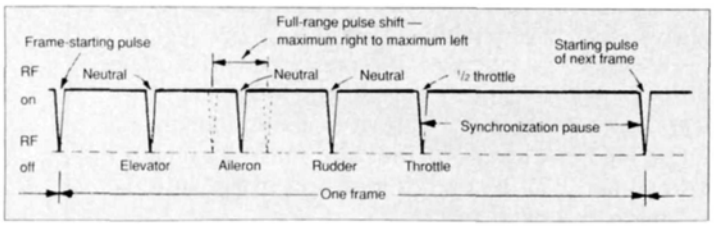
Being more interested in technological developments than with running a business, Don left DCS to collaborate with Phil Kraft and his fast-growing Kraft Systems. At Kraft, Don was responsible for many of the innovations that led Kraft to become a top-ranking company.

With the basic development work at Kraft completed, Don had the urge to move on again, and, again with Doug Spreng, he joined Bob Dunham to establish the Micro Avionics Corp. (Bob took care of the "business" end). Micro Avionics began with a rudimentary digital system, but its greatest claim to fame was the "wood-grain" finish on the transmitter. It did, however, serve to get digital and Micro started. Dunham's Orbit Electronics products were aimed at advanced modelers, so it isn't surprising that Don took Micro Avionics in a different direction. His diligent development work produced a micro system for average modelers. It was quite sophistictaed, simplified and reliable, and these features led to a lower price. Don and Micro operated for a number of years and had many satisfied customers, but when Dunham decided to leave the R/C business, he sold Orbit and Micro, almost simultaneously.

For more than 20 years, Don Mathes was a leading contributor to our R/C capabilities, and it's sad that his work ended so soon. Among his noteworthy accomplishments was the first World R/C speed record, and in 1976, he was honored for his contributions with the Howard McEntee Memorial award.



Digital pioneer Don Mathes established first world R/C speed record with this simple design. A McCoy .60 powered it to 110mph! Note resemblance to a modern sport pylon racer.



The factor that makes digital operation fantastic: pulse-coding of the audio tone. Four channels shown; almost unlimited number possible!

Digital Doings

If all our newfangled R/C systems are fundamentally digital in design (as conceived by Don Mathes), what the devil *is* digital, you might ask. To give you an idea of how far-reaching the original digital concept was, I'll say that most of today's sophisticated electronics is based on this principle. Let's take a look at the basics; our R/C is an excellent example of digital-style remote control.

As is often the case, the digital name describes the idea. Briefly, the desired information is sent in digits or "pieces." The advantage of this is that you can send a multitude of info "bits" very quickly, by wire or radio, often both ways!

With R/C, we have a steady carrier frequency on the 72MHz band. Over this is sent an audio tone that's used for coding, which consists of frames of pulses of the audio tone, each frame separated by a much longer synch pulse (a period during which no coding is done). Thus, each frame of pulses is an entity in itself, and if one burst is faulty, the following correct frame will eliminate the fault. With timing in milliseconds, any interruption obviously has to be very extensive to show up in control reaction.

The coding reverts to something done with Space Control and Good's TTPW. There's one pulse for each channel and servo, and variations in pulse width are used to tell the servo which position is required. A predetermined pulse width is established as "servo neutral." Within established limitations, if that width is *decreased,* the servo will move in one direction from neutral, and the movement will be proportional to the decrease. If the width is *increased,* the action will be in the opposite direction. From any servo position, if the pulse is returned to the predetermined width, the servo will neutralize. Apart from for the very inception of a pulse change at the transmitter, pulses

(Continued on page 74)

BRITISH INTERNATIONAL

DUCTED FAN FLY

Powered by a pair of Thorjet fan units, John Menhennet's Lockheed S-3A Viking gets "Oriental syndrome" (one wing low) on final in a slight crosswind. Recovered smoothly.

The Viojett-powered, scratch-built F-104 of Barry Conway holds short while Bob Ryan launches the Nye Phantom.

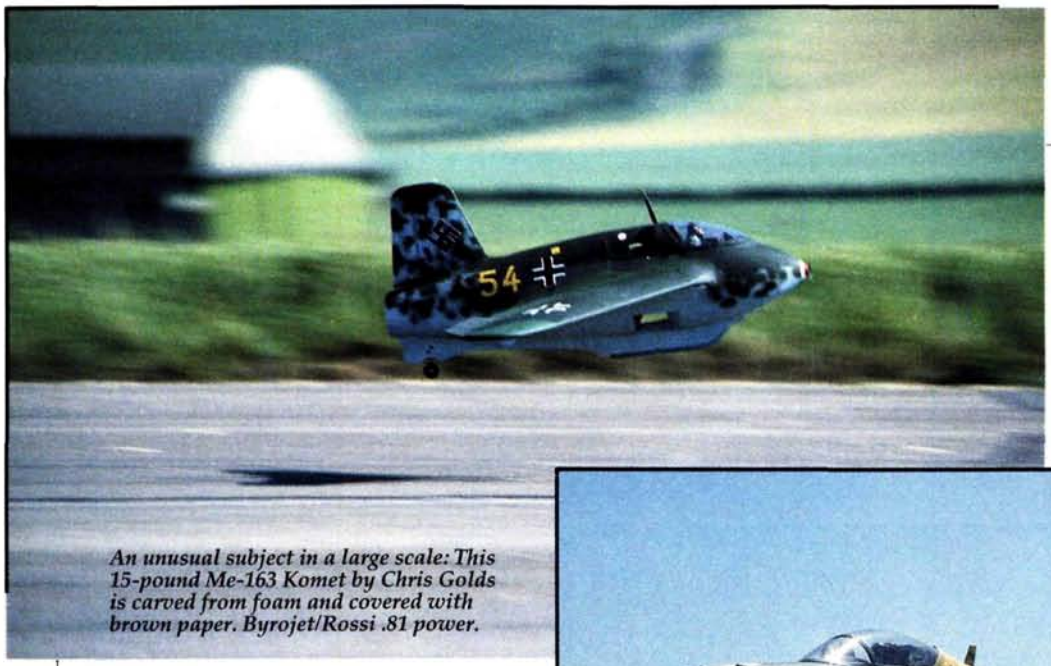
PHOTOS BY RICH URAVITCH

When it comes to grassroots fan activity, it's going to be tough to find an equal!

by RICH URAVITCH

IF YOU review all that has been compiled, written and published about ducted fans in modeling journals worldwide (including our five-year-old "Jet Blast" column), you'll probably find that our neighbors "over the pond" are generally credited with starting it all. Without getting into a long-winded, and probably controversial, discussion about who the pioneers were, suffice it to say that the Brits were "D/F'ing" before most of us.

Having heard so much about their annual Fan Flys, I decided that, at the next possible opportunity, I would try to attend. This was *the year*. After tracking down the names of the prime movers behind some of these events, I called Alec Cornish-Trestrail (Britain's leading proponent of small-diameter fan units) and asked if he could fill me in on when a representative event might be taking place. It just so happened that just such a meet was scheduled for 25 June, which was but a mere three weeks away! I made the required airline reservations, confirmed the itinerary with Alec and prepared for a whirlwind weekend. The adventure started on Saturday morning when Alec



An unusual subject in a large scale: This 15-pound Me-163 Komet by Chris Golds is carved from foam and covered with brown paper. Byrojet/Rossi .81 power.

Bottom: Built from Thorpe Bros. plans, The Northrop F-20 is becoming one of the most popular designs in England. All-wood construction; this example by Graham Preston.

met me at London's Gatwick Airport (a choice I later found to be not the wisest!) and whisked me to the flying site, which is a now-inactive RAF base called Wroughton, about 70 miles west of London.

This Fan Fly was scheduled to coincide with what's called "Open Day" at RAF Wroughton—a rough equivalent of an open house at one of our military installations. This would certainly be an advantage in exposing nonmodelers to one of the more fascinating aspects of our sport, ducted fans. During the whisking-from-the-airport process, Alec explained what the agenda for the weekend would be, and we discussed in depth just how far fans have come and what's going on in the States. The things that immediately surfaced were the marked similarities in fan enthusiasts around the world. We agreed that they were a dedicated bunch of R/Cers, looking for something that represents just a little more of a challenge than simple sport flying.

The fan activity in England has changed considerably over the past few years, and some of this change has come about owing to the more widespread availability of specialized fan equipment like the fan units themselves, high-performance engines, a variety of kits and broader dissemination of information through magazines, books and computer networks. We've all benefitted from it. The more people become involved, the more new products become available. As a result, there's now a large range of commercially available ducted-fan products on the European market where virtually none previously existed.

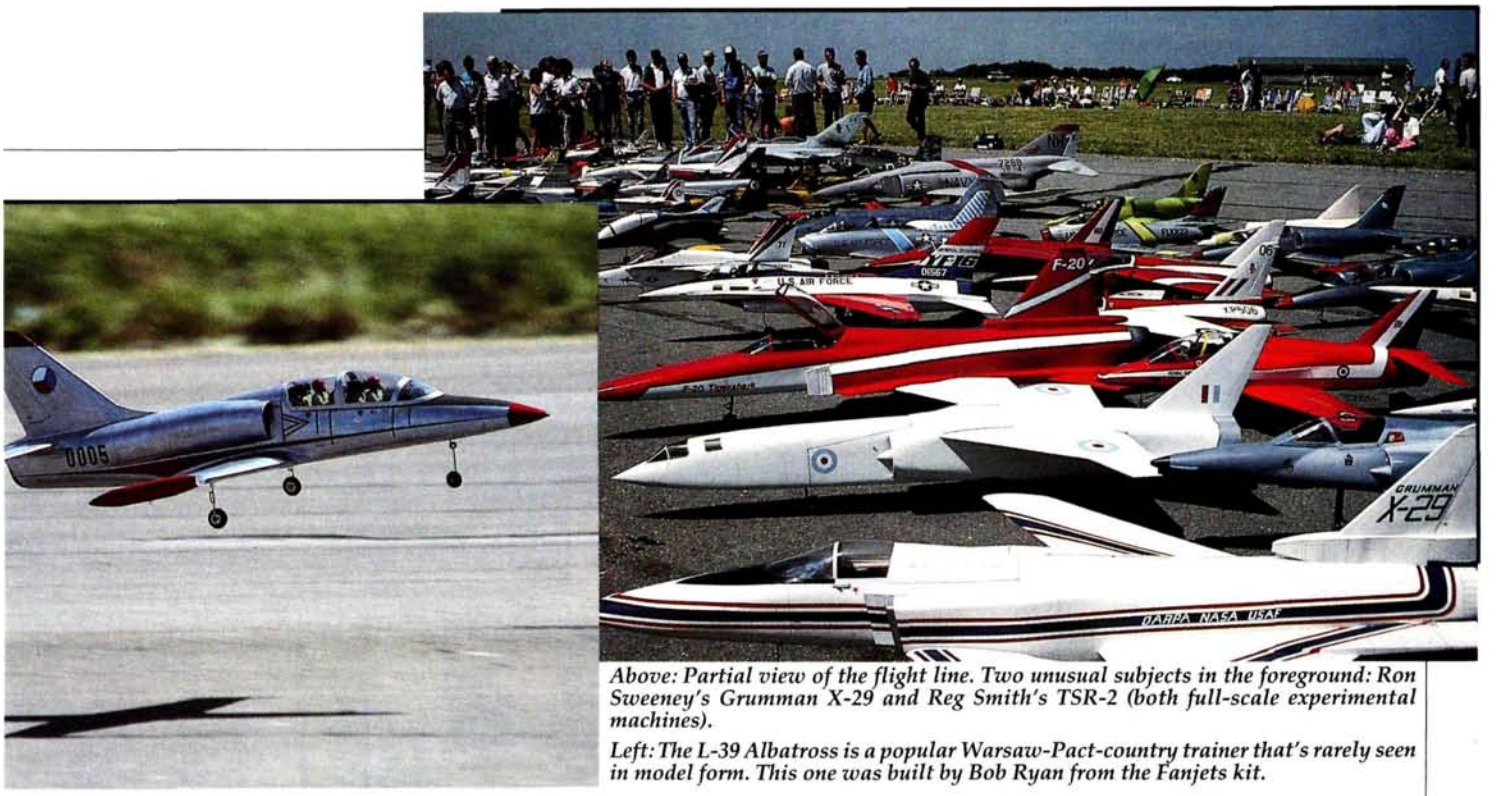
Since Alex had decided to pack as much into 48 hours as he possibly could, on our way to the field we dropped in on another FANatic, Dick Spreadbury, and his lovely wife Christine. Like modelers everywhere tend to do, Dick took me through his shop where he had, like modelers everywhere, projects under way,

FLASH! VIOLETT WINS '89 SCALE MASTERS!

COMPETING against 75 of the best scale modelers in the country—each a finalist in a series of "qualifier" competitions—Bob Violett flew his way to first place in the U.S. Scale Masters finals held in St. Louis. The quality of the models in general was so high (only scant half points in static judging separated most contenders) that the deciding factor was in the air...the flying! Four rounds of flying were scheduled, and in the final round, Bob sewed things up with a nearly flawless performance. Bob's model, a ducted-fan F-86 Sabre, is from a kit produced by his company; it's powered by a Viojett (naturally!) fan unit matched to a KBV .82 engine.

My only question is how does Bob, with a growing, successful business, manage to find the time not only to build a super scale model but also to fly it so well? We should all be so lucky!!

Congratulations, and a *MAN*-to-man salute to Bob Violett!!



Above: Partial view of the flight line. Two unusual subjects in the foreground: Ron Sweeney's Grumman X-29 and Reg Smith's TSR-2 (both full-scale experimental machines).

Left: The L-39 Albatross is a popular Warsaw-Pact-country trainer that's rarely seen in model form. This one was built by Bob Ryan from the Fanjets kit.

projects planned and stacks of pictures showing past accomplishments. Oh yeah; like modelers everywhere, there were also some "remnant" parts!

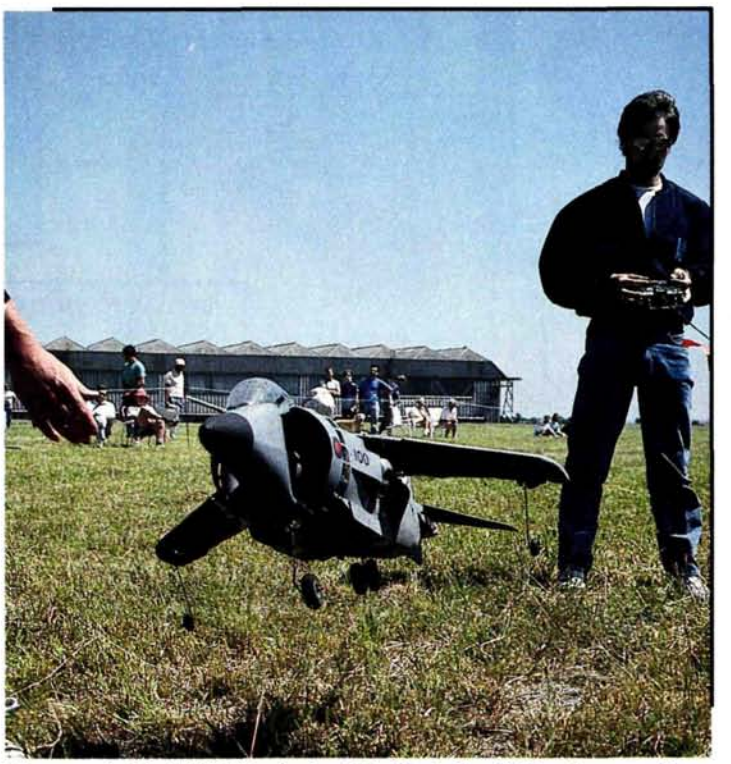
After some additional discussion and a "spot of lunch," we were rolling again toward Wroughton. On our arrival, Alec confirmed that everything was in order for the next day's event. I was introduced to the Site Director for Wroughton, Mr. Ross Sharp, who is, without doubt, one of the most congenial history "buffs" I've ever met. He took me on a private tour of his domain, which is the present storage facility for all the vehicles and material that aren't currently on display in the renowned British Science Museum. (Read the accompanying piece describing the tour.)

That pretty much wrapped up day one, except for the brief stop at the "garage" Alec frequents. We'd call it an automotive repair facility, but whatever it's called, it was the source of the raw materials we needed to do some custom blending of the fuel required for the next day. A bit of this, a touch of that, and a dash of whatever...it looked and smelled like the fuel we used, and Alec was convinced that his engines would love it. So, there we were!

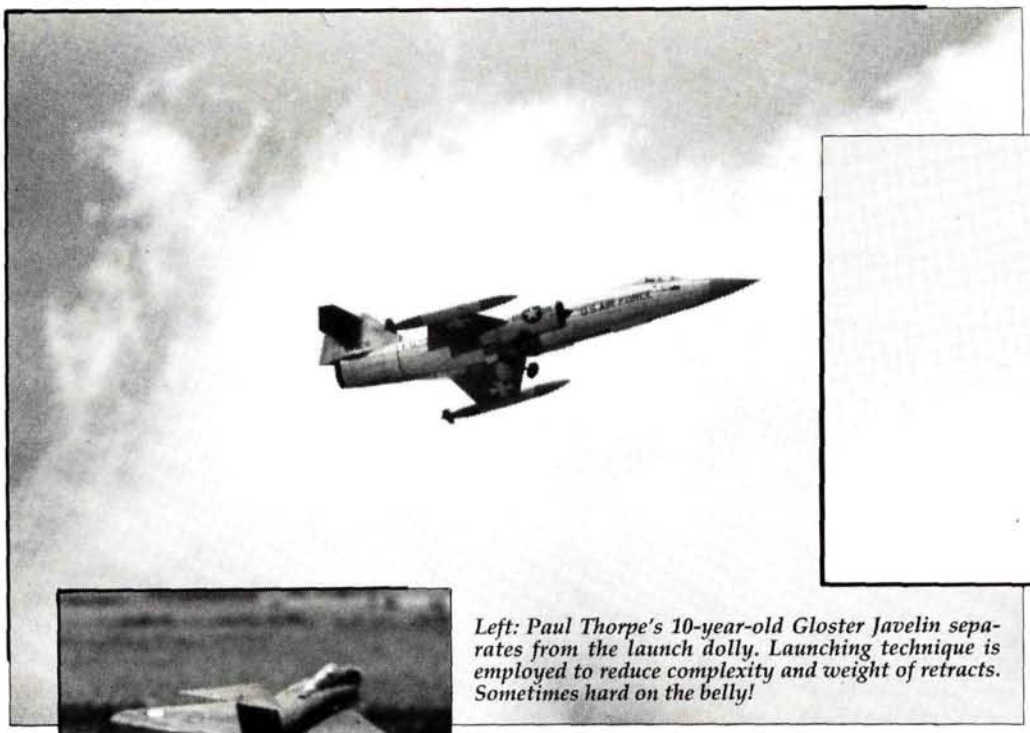
What's next? Dinner, naturally!!—prepared exquisitely by Judith Cornish-Trestrail, who absolutely epitomizes your notion of British style, charm and wit! There you have it; we've consumed nearly a full day, and you haven't heard a rotor turning yet! Stick with it!

I hope none of you accepts the stereotypical picture of British weather. I was told that this summer had been exceptional and event day continued this trend. Arriving early, Alec and I roamed the flight line where I met some of Britain's leading fan modelers. These were the guys I had read about, written about in "Jet Blast" and looked forward to meeting: blokes like Peter Nye of Fanjets, David James of Turbofan and, certainly, the Thorpe Brothers, Peter and Paul.

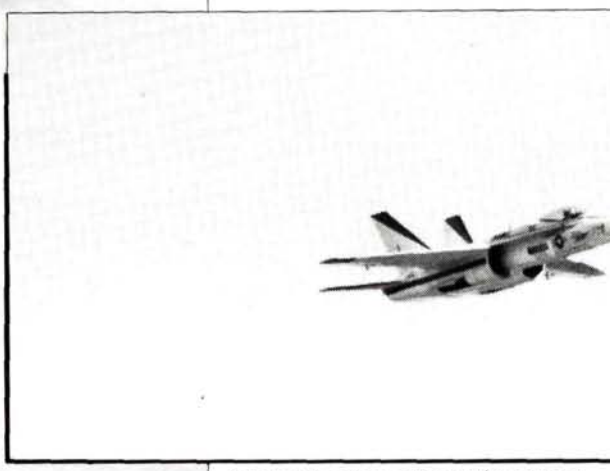
Flying began soon after our arrival and continued throughout the day. Typical of the Fly-In format, those who weren't flying could usually be found in the pits, exchanging information, and peering into the insides of models to see the type of equipment being used. One thing became immediately apparent after roaming the pit area: There's a lot of scratch-built originality in Britain and some rather different construction techniques, also. *(Continued on page 38)*



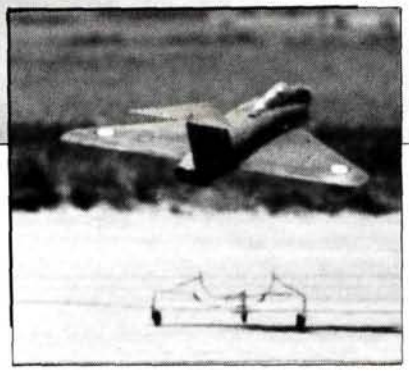
The remarkable VTOL Harrier by Mike Koskelka. He has been working this project for years and can now hover and control it almost routinely. Transition to forward flight is next!



Left: Barry Conway's Starfighter just after takeoff. Note scale gear, just about ready to tuck away.



Above: The Thorpe Bros. F/A-18 Hornet in pre-production color scheme. Single Thorjet; all wood from their own plans.



Left: Paul Thorpe's 10-year-old Gloster Javelin separates from the launch dolly. Launching technique is employed to reduce complexity and weight of retracts. Sometimes hard on the belly!

A number of the *big* models, like Jan Mollmark's 40-pound Phantom (that's weight, *not* British currency!), Chris Gold's 36-pound Tornado (with variable-geometry wing) and 15-pound Messerschmitt Me-163 Komet, were all carved from Styrofoam, covered with brown paper and finished conventionally. Chris uses this technique frequently, most notably on his Concorde of two years ago. I hope to persuade him to prepare an article on this technique, as it certainly seems effective, and I'm sure it's something many of you would like to try.

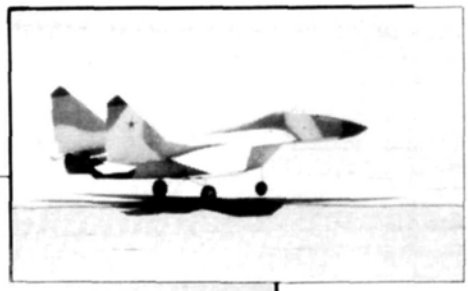
Since I attend many of these jet events, I think my ears have developed an ability to differentiate between many of the fan units by their distinctive sounds. They all

STEPPING BACK IN TIME... RAF WROUGHTON

ALTHOUGH NOT SPECIFICALLY or directly connected to ducted-fan or model jet activity, RAF Wroughton is an aviation wonderland. This now-inactive Royal Air Force base is a controlled storage area for exhibitor material assigned to Britain's famous Science Museum in London. Although only open to the general public on fewer than seven days each year, those fortunate enough to visit this remarkable facility are likely to remember it always.

Wroughton's Site Director, Mr. Ross Sharp, took me on a private guided tour that gave me a chance to see the sole surviving examples of some incredible airplanes and a huge array of virtually every form of transportation and machine. Some examples? How about the number-two Concorde, which was flown in 1969, and a Lockheed Constellation finished in TWA livery! There was German radar equipment from WW II; a Channel-crossing hovercraft; and the engines (still crated) from the Harriers' precursor, the Kestrel. Equally captivating were the huge collections of farm implements, fire trucks, buses, motorcycles and bicycles—all from many years past; all in their original condition; and all part of history.

Mr. Sharp told me that museum problems are the same everywhere: limited staff and even more limited funding. He's working on the staff problem, and I sure hope the bucks (or pounds) become available to allow greater access of this great place to more people. It would be worth every shilling!



Above: Designed and built by Alec Cornish-Trestrail, the MiG-29 Fulcrum was flown masterfully by Paul Leighton. Twin RK-720 fan units.

The meet's heavyweight: the 40-pound carved-foam F-4J Phantom of Jan Mollmark uses the Chris Gold technique. Two Rossi .90s mated to Byrojets provide power.

Alec Cornish-Trestrail retrieves his twin RK-720-powered F-15 Eagle after a typical "gear-up" landing resulting from a dolly launch system. Landing in grass produces virtually no damage.

seem to have their own distinctive note; you can sure tell the difference between the solid, beating sound of a Byrojet* and the shrill shriek of a Viojett* or Dynamax*. Throughout the day, I picked up a sound that I hadn't heard before, and I discovered that it was usually Paul Leighton blasting about the aerodrome with one of Alec's down-sized hot-rod twins. The TD-09-powered A-10 was even more nimble than its full-scale brother, but unfortunately, it succumbed to some undetermined problem. Its stable mates, however, the F-15 Eagle and the MiG-29 Fulcrum (both RK-720* powered and both original designs), were real attention-getters.

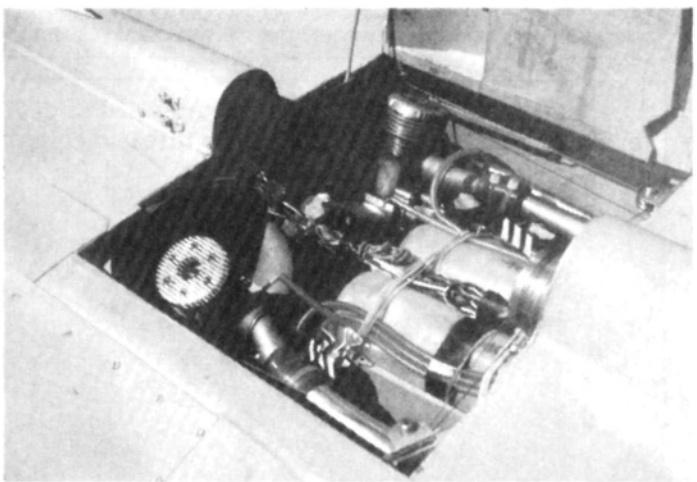
As an obvious sign of fan camaraderie (and with total disregard for the continued well-being of his airplanes), Alec let me fly the Eagle. It may be smaller, but it gives away nothing in performance to larger models; and you simply can't overlook the sound of a twin when both engines are "on song"!

The perseverance award *has* to go to Mike Koskelka for his ongoing efforts to perfect the vectored-thrust requirements of a functioning VTOL Harrier. Mike and his partner in this adventure are on their twenty-first version, and this one hovers nicely and appears quite stable, even in the occasional stiff breeze. The ducting arrangement of air to the four extreme points of the airframe is really very clever but, at the same time, rather simple. (Easy for me to say; he's already done all the work!) Mike thinks that the transition to forward flight and back will be relatively easy after his present accomplishments. I agree and hope to keep you advised of his progress.

Other infrequently seen but noteworthy projects on hand were Ron Sweeney's Byrojetted Grumman X-29, which he taxied around but decided not to test-fly at the meet. I hope it has been flown by now; it sure looked great! Some others that caught my eye: Barry Conway's beautiful Lockheed F-104 Starfighter with a scale gear that was exquisitely executed; John Menhennet's foam, twin-Thorjet-powered Lockheed S-3A Viking; the TSR-2 and BAC Lightning of Reg Smith. I was interested and pleased to see that nearly all the models were of the scale, or at least sport-scale, variety. It's no secret that the Brits are past masters of the art of R/C scale, and their choices in jet subject matter seem to reinforce that position.

Flying was suspended at lunch time, when all the models were brought to the center of the runway and the throngs of spectators were invited to photograph and inspect the models up close and ask their builders any questions they had. This is one of the most effective means of rais-

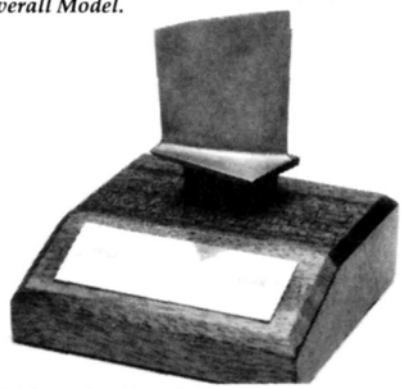
British fan pioneer, Peter Nye, was on hand with a small fleet of airplanes. The two Grumman F9F-2 Panthers here feature carbon-fiber fuselages and O.S. .77/ Dynamax propulsion.



Innards of Chris Gold's variable-geometry Tornado. Twin Rossi; .81s with Byrojets. Arrow points to drum drive for cable-operated wing sweep.

BRITISH FAN FLY


Our editor (left) presents World Champion Phil Avonds from Belgium with trophy for Best Overall Model.


Unique, hand-crafted trophies were presented in three categories—plus this one for our editor that said simply, "Thanks For Coming."! Thanks!

ing the general public's awareness of our sport and should be considered for incorporation into the schedule of any R/C gathering. We can use all the positive exposure we can get!!

Flying continued in the afternoon and was concluded with the awarding of unique trophies that had been handcrafted by Dick Spreadbury. As befits a jet meet, each trophy consisted of a full-scale turbojet compressor blade mounted on a lacquered wooden base to which was attached an engraved brass plate. World Champion Phil Avonds' plaque read "Best Overall Model"; Steve Elias', "Best Overall Flying Performance"; and Chris Gold's, "Most Outstanding Technical Achievement." Presented by Ross Sharp, mine said "Thanks For Coming." Thanks for having me; it was my pleasure, each of you guys is terrific. Just as I expected, we really *are* a global fraternity! If you're ever in the Colonies, look me up; I'm the guy with the funny accent!!

**Here are the addresses of the companies mentioned in this article:*
Byrojet; *distributed by Byron Originals, P.O. Box 279, Ida Grove, IA 51445.*
Viojett; *distributed by Bob Violett Models, 1373 Citrus Rd., Winter Spring, FL 32708.*
Dynamax; *distributed by Jet Model Products, 304 Silvertop Lane, Raymore, MO 64083.*
RK-720; *distributed by Kress Jets, Inc., 4308 Ulster Landing, Saugerties, NY 12477.* ■

Quiet Flight

by JOHN LUPPERGER

Of kits, deco and working winches

THE BIGGEST CONTEST of '89 is now history, and it was *great*. The '89 Nats soaring events were the biggest ever, with 389 entrants, and no one was disappointed—a great venue, a great location and *great* people. I went (flew lousy!) and had a great time. Elsewhere in this issue you'll find my complete report on "Soaring at the '89 Nats."

Glider Graphics

Earlier this year, I ran some info on a company known as Mr. Sticker*. It makes all types of vinyl stick-on graphics for full-scale off-road racers and also for modelers. After running that piece, I received information from two more companies that specialize in vinyl lettering.

Aero Graphics* was founded *by* modelers *for* modelers, and it now has over 25 years' experience in the sign and design business. Their vinyl letters are available in 1/2- to 24-inch heights, in 1/4-inch increments, in nine type styles, in 20 colors, in forward or backward slant up to 40 degrees, and they can also be cut in mirror image for mounting inside windows. For more information and prices, write to Aero Graphics, and tell them you read it in *MAN*.

The other company is Vinylwrite*, which was also started by a modeler to serve fellow modelers. Lettering is available in 1/2- to 12-inch heights, in 1/4-inch increments, in eight different type styles, in 15 different colors, in forward or backward slant up to 40 degrees, and in mirror image. They also have stars from 1/2 inch to 12 inches in 15 colors. Joe Wagner provided a pictorial step-by-step way to apply them in the September issue. For more information and prices, write to Vinylwrite directly.

Larry Paquett of Fresno, CA, converted a Jet Hangar Hobbies' F-86 into this great-looking power scale sloper. Model flies well and shows a lot of promise.

Banzai Enterprises

Banzai Enterprises* has gone into production with its first kit, the Banzai. It's 60 inches in span with 450 square inches of wing area. At a flying weight of between 28 to 35 ounces, it yields a wing loading of 9 to 11 ounces to the square foot. The sloper's favorite airfoil, the Eppler 374, gives the Banzai excellent penetration along with good slow-speed handling. The wing has a spruce spar and is covered with Kromekote. It has proven to be very durable, and when it does break, it's quick and easy to repair.

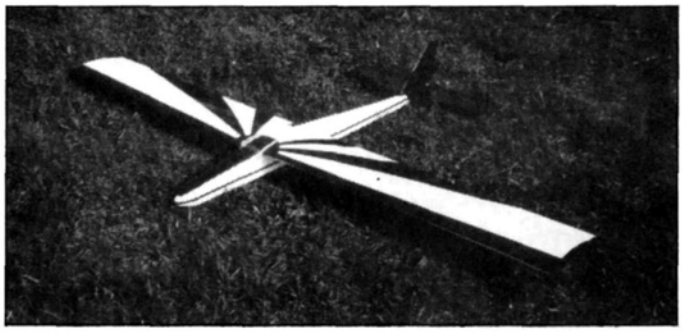
The kit includes: foam-core wings; Kromekote wing sheeting; balsa leading-edge, trailing-edge, and aileron stock; machine-cut balsa and plywood parts; comprehensive instructions and a scale drawing (no plan is necessary owing to its simple construction).

It's available from the manufacturer for $32, and on any order of three or more kits, there's a 10-percent discount. Include $3.50 postage for each kit ordered, and don't forget to tell them where you saw it!

Bernard Cawley of Auburn, WA, with 1/6-scale '46 Taylorcraft that won 2nd place in Sport Scale, Sportsman Class at '89 Nats. First time an electric model has ever won a trophy in a Nats power event!

Good-Looking Winch

While participating at the Nats, I met many people, including Wayne Fredette. Wayne runs WL&J Enterprises, Inc.*, which makes launch equipment and supplies. I saw one of Wayne's winches and was really impressed with the quality of materials and workmanship. The winch is very sturdy and has a ratchet-type anti-backlash brake. The winches cost $350 (C.O.D.), plus shipping and handling. The turnaround is also a very sturdy unit and sells for $35. Wayne also sells drums (with and without brakes), winch lines, ball bearings, swivels and parachutes. Send for a complete price list and tell Wayne you saw it here.



Banzai Enterprises' new Banzai slope glider. Model's simple construction makes it very rugged and easy to repair. Its ability to withstand abuse should make it good for training and for slope combat.

New Electric Motor

Hi Line Ltd.* is a new company catering to sport electric fliers, especially those interested in compact models. A catalog of all its products is available for $1, and you know where to tell them you saw it!

Hi Line sent me info on its new motor, the Elf-50. This 50-watt motor weighs about 2 3/4 ounces and is perfect for models of about 300 to 400 square inches with a flying weight of 16 to 22 ounces. It will run on a 4-cell battery pack and will swing 6x4 to 7x4 props.

The motor alone costs $15.95; with a wiring harness, including connector, switch and fuse, it costs $19.95. The Elf-50 should fill the void left by the Astro 020 and 035 ferrite motors.

Electric Scale at the Nats

No, there wasn't an electric event at the Nats, but an electric-powered model took 2nd place in R/C Sport Scale. Electrics have really come of age! This information came to me by way of a press release from the Boeing Hawks-Puget Sound Electric Model Flyers. I'll let Ben Almojuela take over.

"For the first time in the history of the AMA Nats, an electric-powered model aircraft has placed in powered radio-control competition. A 1/6-scale reproduction of a 1946 Taylorcraft, built and flown by Bernard Cawley of Auburn, WA, received 2nd-place honors in R/C Sport Scale, Sportsman Class.

"Bernard competed against seven other modelers in the category during the '89 Nats held in the Tri-Cities, WA, on July 15 to 23, 1989. It was Bernard's first major competition.

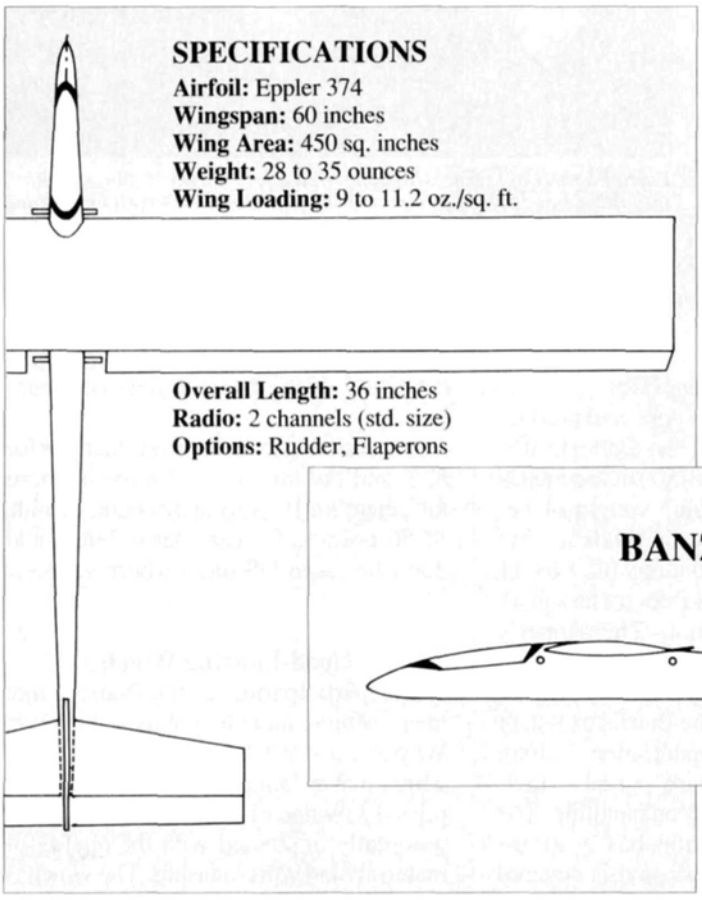
"The model is a reproduction of a full-size Taylorcraft that's owned by Harry Flannigan and operated out of Crest Airport in Kent, WA.

"The 1/6-scale model spans 6 feet and was developed from the Taylorcraft full-scale drawings. The model's powerplant is a Challenger 40 electric motor manufactured by Astroflight Inc.*, and it features samarium cobalt magnets. A stock Astro 1.7:1 gear reduction is used to turn a Graupner 12x7 prop. Electric motor power is supplied by 18 1.2Ah Ni-Cd rechargeable Sanyo cells.

"Proportional motor speed control is provided using an SC-4 speed control manufactured by Jomar, Inc*. The aircraft radio used for control is a 4-channel Vanguard FM from Airtronics, Inc*.

"Bernard, age 33, has been interested in model planes since age seven and has been involved with R/C electric-powered models for the last 10 years. He's currently an engineer with the Boeing Company in Renton, WA. He's a member of the Boeing Hawks R/C Flyers and is one of the founding members of the Puget Sound Electric Flyers."

If you recall, I've run a couple of Bernard's motor reviews in past columns. I think that his accomplishment at the Nats is *fantastic*. On behalf of all electric fliers: Congratulations, Bernard!



F-86 Power Scale Sloper

More and more P.S.S. slope kits are showing up out here on the West Coast, but there are still modelers who want something different, something not readily available or already modeled. Larry Paquette of Fresno, CA, is one such modeler. Here's an exerpt from the letter that came with Larry's picture:

"I've enclosed a picture of my recently completed F-86 model. What makes this model unique is that I've built it to be a slope soarer! The airplane is built from the 1/9-scale Jet Hangar Hobbies* kit that's designed to be a fan jet. The kit came with a fiberglass fuselage, clear canopy, and foam cores for the wings.

"During the two years it took me to complete this model, I made many modifications to accommodate the needs of a glider. These changes included adding three formers to stiffen the fuselage, building a "flow-through" tube from the inlet to the outlet, enlarging the ailerons by approximately 25 percent, and making the wing into a three-piece assembly for ease of transportation.

"The model has three channels: rudder,

elevator and ailerons, with the rudder and ailerons coupled through the Futaba 7-channel FM radio that I use. The tail feathers are built up of 1/4-inch balsa glued together and sanded to shape. The aileron servos are mounted in the wing, and they move the surface via a linkage to a Swingee hinge. Control to the rudder and elevator is through a cable system, with a yoke required for the elevator.

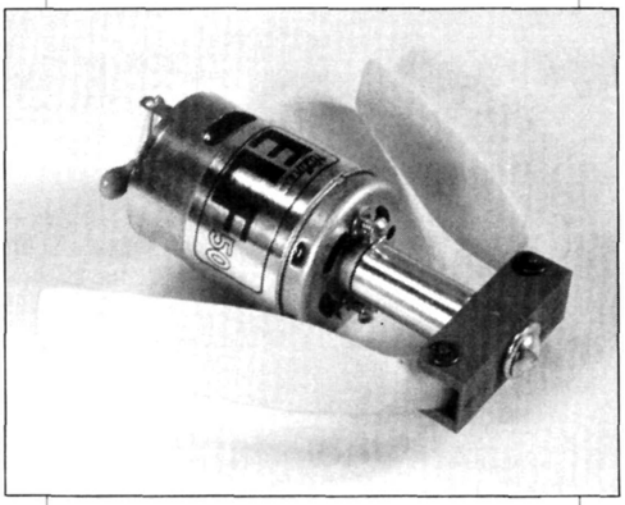
"There's a 1200mAh battery in the nose to provide more than enough power to the receiver and four servos. The weight of the battery also minimized the amount of lead required for balance.

"At the moment, the F-86 has flown once and performed better than expected. Much like the full-size airplane, it's sensitive in the roll axis—owing to the swept-wing configuration, I suspect. It's very stable in pitch and yaw axis, and it tracks very well through a turn. It isn't fast in the air, but when flying, it looks very scale-like. I plan to continue to tune this airplane, and I'm certain that I'll have a great deal of enjoyment with it as time goes on. It certainly is a one-of-a-kind 'Sloper.'

"Keep up the fine efforts of your magazine; I look forward to every issue."

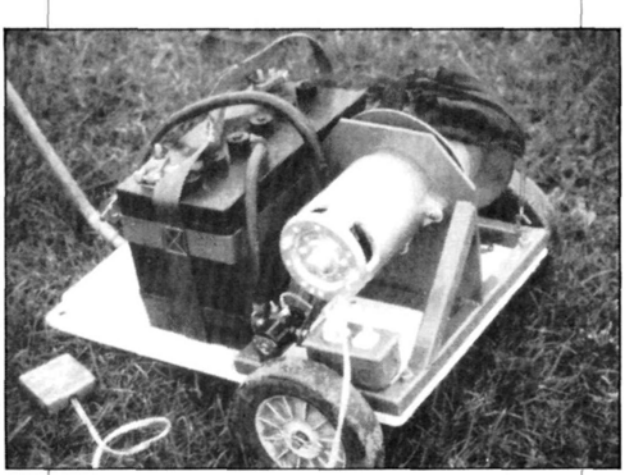
Larry's F-86 is certainly an interesting and ambitious project. Has anyone else out there converted a ducted-fan model into a power-scale sloper? If so, send us some info and share your project with the rest of us.

(Continued on page 102)



The Elf-50 from Hi Line Ltd. will make a great replacement for the Astro ferrite 020 and 035, which are no longer available. Prop shown is a Sonic Tronics folder (not included with the motor).

Good-looking winch from WL&J Enterprises, of Tinley Park, IL, features a ratchet brake to prevent backlash during zoom launches.



Giant Steps

by DICK PHILLIPS

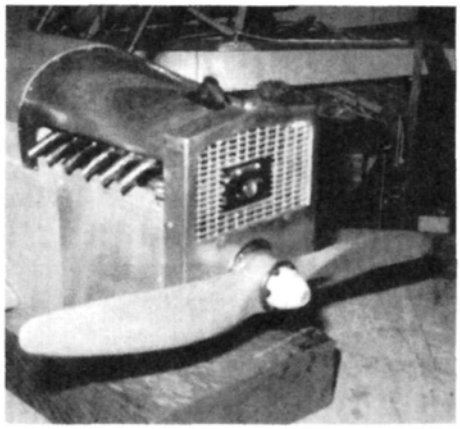
Water, Waco

IT SEEMS THAT the announcement of the demise of the Quadra engine was slightly premature, thank goodness; we recently heard news of its rising, Phoenix-like, from the ashes. Klaus Nowak, who has been involved with the marketing of Quadra engines for many years, has teamed up with Aerrow Inc.,* of Canada, to continue the line.

As well as resuming production, a new warranty facility for the U.S. has been established: B&B Specialties* has taken over the warranty depot from U.S. Quadra. The company's Bill Bennett is a well-known supplier of accessories for larger models as well as a number of engine and Quadra accessories, and B&B's reputation gives us reason to expect a continuation of the excellent parts and warranty service we've come to expect for the Quadra line.

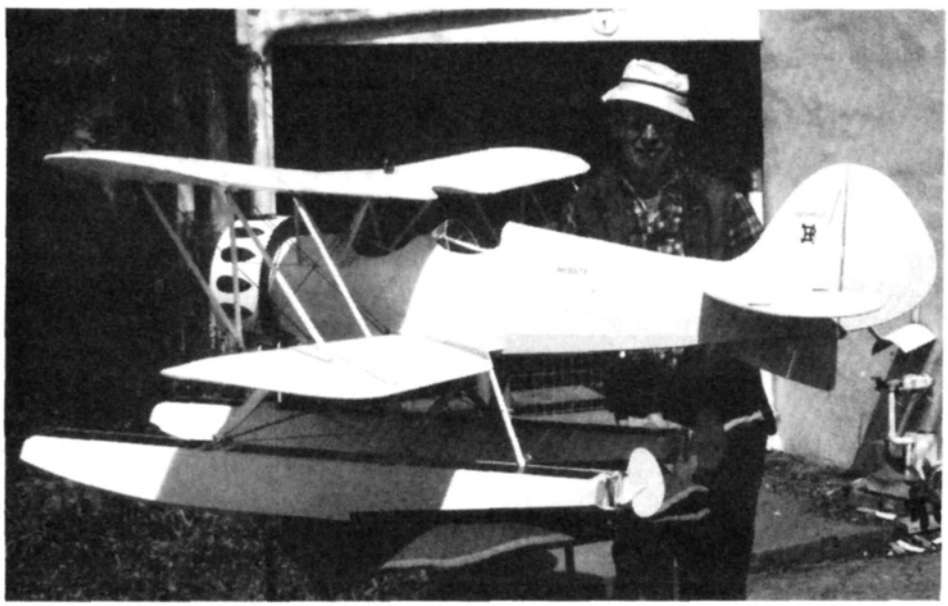
Aerrow plans that engines will reach the market in August, and production schedules indicate this sequence: the Q5OSS, Q42CD, Q100, Q42P, Q35S plus short blocks and the old standby, the Q35.

Aerrow already produces three engines of its own: the A75, the A140 and the A200. The A75 is available with either battery or magneto ignition, and it displaces 4.5 cubic inches (75cc). The A140 displaces 8.5 cubic inches (140cc), and the A200 displaces 11.4 cubic inches (188cc). Obviously, at that size, the A200 is something of a muscle machine; it's probably the biggest I've seen for model use. (I once saw a 1/2-scale model that used a builder-converted Husqvarna 13-cubic-inch engine, but that was a one-of-a-kind situation.)



Hershey does some exquisite work, as can be seen from this view of his World Cruiser. He researches his models carefully and then builds appropriately.

It's good to see the engine that started all this giant-scale activity getting a new lease on life. Quadra has always produced the least-expensive large engines, and we can only hope that this will continue.



Dick Hershey with his Waco UBF-2 on floats. Dick is a super builder.

Schneider Scoop

Last month's Seaplane Issue contained information on the Schneider Cup re-enactment scheduled for November at Lake Havasu City, AZ. Several Californians have test-flown their entry—the winner of the 1913 Schneider Cup. It's a Deperdussin that was built jointly by Dick Skoglund and "Frenchie" LeBlanc of Lancaster, CA. No doubt, they'll be eager to attend the November event.

Jim Pepino has announced an update to the Supermarine S-6B plans. It's an alteration to the landing-gear angle, and if you have a set of the plans and haven't received the update, write to Jim at Scale Plans and Photo Service*. It was recently announced that Fiberglass Master* now has a cowling and floats in fiberglass, and you can write to them for more information.

If you're interested in more details of this event, or want to receive an entry form or the newsletter, give event chairman, Bob Martin*, a call, or write to him at the address shown at the end of this article. Bob will put you on the mailing list and keep you in touch with all Schneider Cup event happenings. I have the most recent newsletter, and it's a well-done, five-page publication filled with nitty-gritty details of progress on the event itself, news of the plans available and the model requirements. Information on accommodations is also provided, as are the addresses and phone numbers of the suppliers mentioned.

This newsletter is one of the best publications of this type I've seen, and it appears regularly (an excellent way to keep both contestants and observers in touch with progress in any event). Many events like this could profit from the type of work being done by Bob. I only hope he doesn't "burn out" as a result of all the time and work he puts into the Schneider Cup re-enactment; it would be a shame if

nd Photo Tips

the event didn't become a regular occurrence. Nice work, Bob!

Wonderful Waco

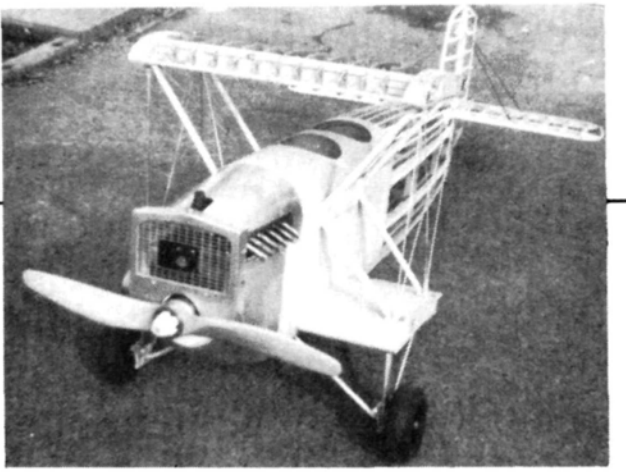
Richard B. Hershey of Lakeport, CA, is a superb builder, and I've shown examples of his work here in the past. His latest effort is shown in the accompanying picture. It's a Waco UBF-2, and Dick sure knows *my* weakness! I've always had a soft spot for Waco airplanes, and Dick's is another Waco beauty. The floats are a result of Dick's location; he lives on Clearlake and is a charter member of the Clearlake Renegades.

I particularly like the UBF-2's clean lines, and it's obvious from the quality of the workmanship that Dick Hershey is a fine builder. He tells me he hasn't yet worked out a color scheme, but he promises to send photos when it's completed and flown. It looks so good *unfinished* that I didn't realize it *wasn't* complete until I read Dick's letter.

Although it has since been sold, Dick's Grumman is an impressive bird. Most of his models are a touch out of the ordinary and represent his dedication to accuracy.

Namesake News

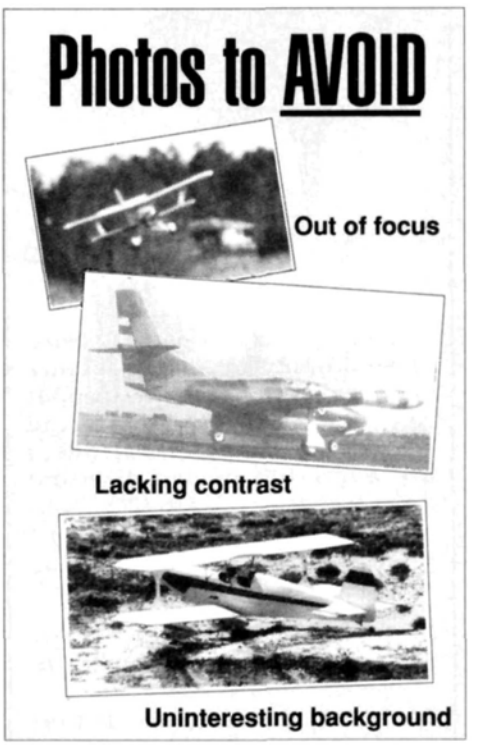
It seems to be my month to receive letters from my namesakes. Dick Konkle from Smyrna, GA, wrote recently and included a picture of his design for a Jodel D-9 built by Ivor Eloff of South Africa. The Jodel uses an O.S.* Gemini 160 opposed twin for power, and it drives an 18x6 prop at 6,200rpm. It's a nice, simple structure, not too difficult to build or detail, and I hear it's a smooth, easy flier. Dr. Eloff adds, "I can only hope that more modelers will see the light and build an aircraft that's capable of producing good scores in competition, as well as being a scale model that can be flown every Sunday." (The plan for the Jodel was published in the September '84 issue of *MAN.)*



Dick Hershey's World Cruiser. Exhaust stacks conduct the model exhaust outside the cowling.

Dr. Eloff flew the Jodel in the 1989 South African Scale Masters and managed a very respectable 2nd place (not bad for a non-military model—and a homebuilt, at that). He was topped by a Tiger Moth that received bonus points for biplane and tail-dragger. Ivor's Jodel received the highest static score in the competition: 1,812 out of a possible 1,950. The Jodel actually earned higher flight scores, and it's gratifying to see that WW II "big iron" isn't the only thing that can take top honors in scale competitions at the Masters level.

Dick Konkle is currently doing the design work on a Morse Prowler. He's scratch-designing the model from a set of three-views and some photographs provided by a friend. Two and a half years have gone into the work so far, and it's coming along well. Dick uses a Sachs-Dolmer 3.7, which has been modified to permit throttle-coupled spark advance. The model is skinned with 1/48-inch plywood and had been primed when I last heard from Dick. I'm looking forward to seeing more of this interesting and, as far as I know, unique, model.



Picture Perfect

I know that there are many unique models, but we seldom hear about them. We who write regular columns are always interested to hear about these wonders and, judging by the reaction I get, so are our readers. If you're working on designs you think are unique, let us know about them; send us photographs; spread the news!

I have a few comments about photographs: Over the past 20 years or so, many of you have shared your modeling activities with us by sending us your pictures. Those pictures don't always appear here (or in the columns of other writers), but it *isn't* because we don't want them, or

GIANT STEPS

Jodel by Dr. Eloff of South Africa. Model took 2nd in the S.A. Scale Masters earlier this year. Unusual for a relatively simple model to do well in such competition.

I included this photo, taken in Nova Scotia, for all you Northerners who retired and moved to the Sun Belt, to remind you how much you miss winter! This picture was taken at -10 degrees by Jack Maloney—obviously a hardy soul. Happy flying!

won't use them. In many cases, the photographs just aren't good enough and won't reproduce well to do justice to your workmanship. If you want to send pictures, please do; we welcome them and appreciate your sharing them with us, but here are a few tips about what we need:

- Fuzzy Polaroids just don't cut it. They won't reproduce well, and we'd be wasting valuable column space by trying to duplicate them.
- We need sharp, clear pictures with the airplane in good focus. When you're taking pictures, use as small a lens opening (numerically high) as is possible under prevailing lighting conditions. Even on automatic cameras, you can alter the opening by lowering the shutter speed, but don't go below 1/60 second without using a tripod.
- Focus on a part of the airplane that's about one-third of the way back from its closest point. This will usually provide reasonable sharpness from the front to the rear of the model. The sharp area is known as "depth of field," and it can be increased by using the smallest possible opening (f-stop).
- Good-quality color or black-and-white prints are acceptable, but good black-and-whites generally reproduce better than good color shots.
- It's important to set up the model against a plain background with as few distracting features as possible. Out in the open is best.
- Shoot from scale eye level if possible, i.e. on a 1/4-scale model, eye level would be between 12 and 13.5 inches above ground level. Models look much more realistic if photographed from eye level.
- Just before you click the shutter, move your eyes around the edge of the view finder. Check that there are no distracting features, e.g. a tree "growing out of" the vertical fin, etc.! (This sort of thing really looks out of place in a two-dimensional photo.)
- Try to set the model on a surface that looks scale-like. Nothing looks worse than an airplane sitting among blades of 4-inch-wide grass! Some of the best model pictures I've seen have been shot at small country airports with the model sitting on a paved surface. The plane looks very realistic if the background shows out-of-focus hangars or other airplanes. Generally, it isn't too difficult to arrange to take your pictures at these small airports. They aren't like big-city airports with wire fences prohibiting entry for the purpose of photographing a "toy airplane."
- Fill the frame with the model, but don't "cut off" any part of it. "Filling the frame" means that there's plenty to work with without having to crop half the picture because there's nothing in it.

By following these few simple rules, you'll produce photographs you'll be pleased with, and we'll be delighted to use them. Keep 'em coming; we like to see what you've been up to!

**Here are the addresses of the companies mentioned in this article:*

Aerrow Inc., *P.O. Box 189, Agincourt, Ontario, Canada. M1S 3B6.*

B&B Specialties, *14234 Cleveland Rd., Granger, IN 46530.*

Bob Martin, *1520-C Acoma Lane, Lake Havasu City, AZ 86403. Tel: (602) 855-6900.*

Scale Plans & Photo Service, *3209 Madison Ave., Greenboro, NC 27403.*

Fiberglass Master, *Rte. 1, Box 530, Goodview, VA 24095.*

O.S./Great Planes Model Distributors, *P.O. Box 4021, Champaign, IL 61820.* ■

FUTURE FLIGHT KLINGBERG Wing SAILPLANE

An unusual glider - its very shape takes us into the future.

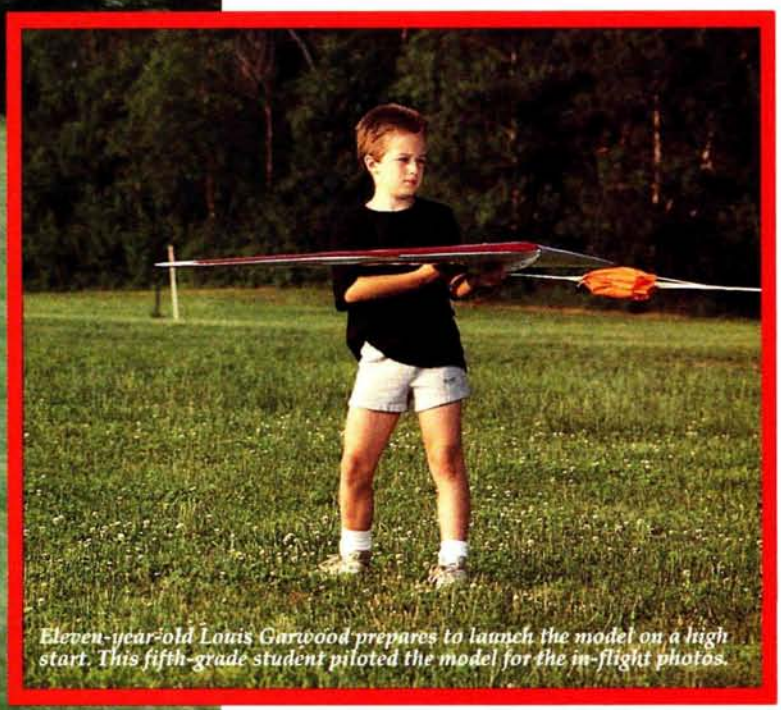
by DAVID D. GARWOOD

THE KLINGBERG WING from Future Flight* is a swept-wing, highly maneuverable 2-meter sailplane. It isn't a particularly easy glider to build, but it's very well engineered, and it includes some unusual design features. Time spent on constructing this kit will reward the modeler with a fine-flying aircraft that looks like a stealth bomber.

SPECIFICATIONS

Type: *Flying-wing sailplane*
Span: *77 1/2 inches*
Weight: *26 ounces*
Area: *670 square inches*
Wing Loading: *5.6 ounces per square foot*
Power Req'd: *none (.049 optional)*
No. of Channels Req'd: *2*
Suggested Retail: *$59.95*
Features: *Unusual-looking, highly maneuverable sailplane requiring only simple 2-channel radio equipment with standard-size servos.*
Comments: *Not the easiest model to build, but an excellent flier. A lot of thought has gone into the engineering of the aircraft design and the kit design, but only traditional, familiar materials are used in construction.*

Aircraft on final approach turn. Only two channels are needed for aileron and elevator control (mixed electronically or mechanically for "elevon" control surfaces). In-flight maneuverability is excellent.



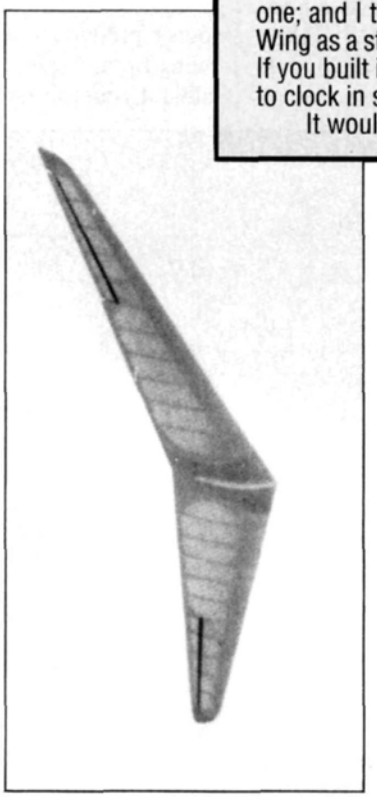
Eleven-year-old Louis Garwood prepares to launch the model on a high start. This fifth-grade student piloted the model for the in-flight photos.

The model was designed by a group of aeronautical engineers from Lockheed. It's a scale model made for stability testing during the development of a full-scale foot-launched glider, and its name comes from that of its chief designer, Rollin Klingberg.

THE KIT: The balsa parts include quality die-

cut wing ribs, 1/16x4x48-inch leading-edge sheeting, 48-inch spars, 1/16-inch shear-web material, rib cap-strip material and shaped wing-tip blocks. Birch plywood is provided for the landing skid, the radio box and the optional winglets and power pod. The hardware provided includes Sullivan* Gold-N-Rod pushrods, Du-Bro* bellcranks, a threaded rod and molded plastic clevises. The additional materials you'll need to complete the kit are adhesives, covering, a 2-channel radio with standard-size servos, hardware for the servo end of the pushrods, and a pair of tow hooks if the plane is to be launched with a high-start.

The two sheets of blueline prints contain construction drawings, cutting patterns for parts and the wing jig. The 18-page instruction manual is well-written and presents the building sequence in 28 numbered steps and power-pod construction in six additional steps. The manual is illustrated with 35 photographs. Included in recent kits is a very useful four-page pamphlet called "Building Hints and Tips." If you don't get one in your kit, write to Future Flight and they'll send you one free of charge.



CONSTRUCTION: The instructions are clear and well organized, and they present the construction steps in a logical order. The kit has a pattern and instructions for making a wing jig of corrugated cardboard. Constructing the wing on the jig facilitates alignment and the creation of wing-tip washout, and Future Flight cautions, "The wings must be built on this jig, or the model will not fly." I believe it!

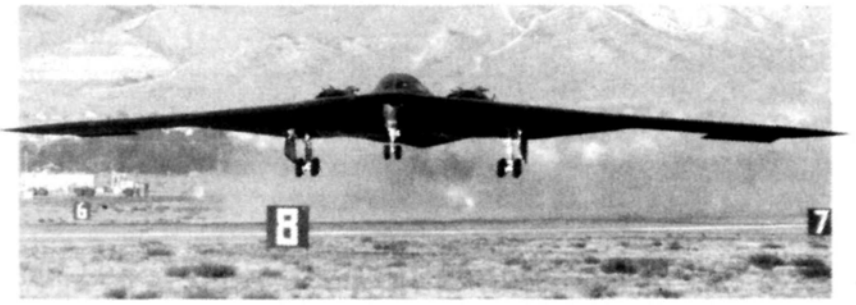
Begin by building the wing jig and pinning the bottom spar to it, and then pin the lower trailing edge to the building board. Ribs are glued onto the lower spar using marks on the wing jig for spacing. Add the top spar, the leading-edge strip and the upper leading-edge sheeting. Applying the lower sheeting is easy if you use a movable building board (as shown in the instructions) or have a free-standing workbench that allows access to the back of the wing jig. It's difficult to work on the lower sheeting from the same side. When the upper and lower leading-edge sheeting has been completed, install the shear webs. I used CA to secure the ribs and webs, and aliphatic resin (tan) carpenter glue for the sheeting.

When the glue is dry, remove the wing from the jig to install the wing-tip block, the bellcrank and the aileron. The instructions are clear on making the aileron, and even though this was only my second aileron wing, I had no trouble completing the assembly. The design provides for a control horn inside the wing itself, so making the aileron control linkage invisible and more resistant to damage than that on conventional mechanisms. (Nice touch!)

I substituted Sullivan Gold-N-Clevises for the control linkages inside the wing, because the plastic clevises supplied in the kit repeatedly popped open during assembly and bench testing. The plastic clevises are OK inside the radio compartment, where they pop open occasionally, but here they can be reached easily and fixed.

The next step is the construction of the other wing. When both wing halves have been built and joined, the landing skid is completed, the radio box is constructed, and the receiver antenna and the pushrod tubes are then installed.

Since there's only one pair of movable control surfaces, the elevator and aileron servo outputs must be mixed, as control movements for both pitch and roll functions are provided by the "elevons." If you have an advanced radio, this can be done in the transmitter with a V-tail mixer, or you can use a sliding servo tray. I elected to

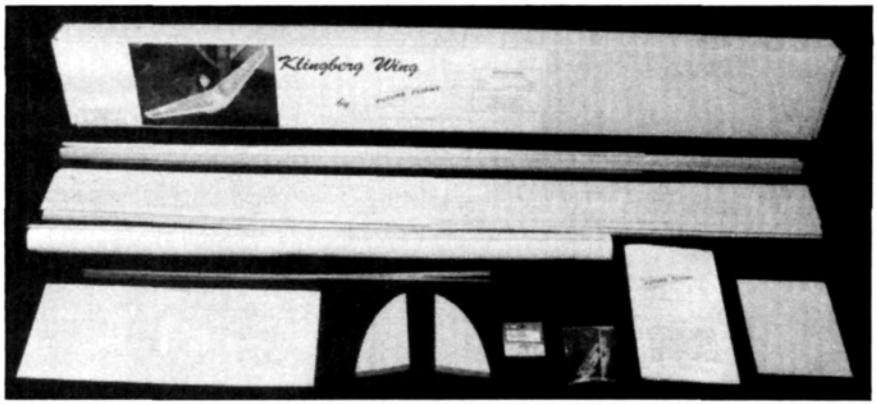


B-2 or not B-2? *That* is the question!

Called the "Stealth Bomber" (at least until something snappier comes along), the new Northrop B-2 has entered its flight-test program at Edwards Air Force Base in California. Some will call it ugly (they're probably looking for a fuselage and empennage group); others will call it sinister (until they remove the black RAM coating, paint it silver and apply American Airline's markings); still others will call it dated, recalling Northrop's early fighters; but no one will dare to call it cheap! At more than $.5 billion a copy, it makes reasonably expensive lodgings for its three (perhaps four) aviators.

I love it for the technology it employs; I'd jump at a chance for a hop in one; and I think it would make a great ducted-fan R/C model. Using the Klingberg Wing as a starting point, you'd only have to add a fan, retracts and a cockpit bubble. If you built it exactly to scale, would its low radar cross section make it impossible to clock in some of the jet speed events that are becoming so popular?!

It would sure make an interesting model. Who'll be first?!



Kit contents include balsa and plywood, two sheets of rolled plans, most of the hardware needed and a photo-illustrated instruction manual. Shear-web cutting pattern and stack of shear webs are shown in the lower right of the photograph.

use the sliding servo tray. Full-size drawings, materials and complete instructions are provided, and the method has worked well on the bench and in flight.

One nice feature of the model is that it can use a simple radio set with inexpensive, standard-size servos. Obviously, smaller equipment can be installed, but it's not essential. Wing loading is so light that radio and battery weight isn't a problem. I put the receiver and battery pack inside the leading edge to get the center of gravity within the specified range, and no additional weight was needed to balance the airplane.

Good news! When you've finished with the wing, you've finished with the airplane, as there's no fuselage or empennage to worry about. I covered the model with Top Flite* MonoKote and found it entirely satisfactory. The photo of the model on the box shows transparent covering material, but this might *not* be the best choice of color scheme. This model can sometimes be difficult to see, and contrasting top and bottom colors or patterns will help you tell when it's inverted.

I deviated twice more from the manufacturer's instructions: I ended the aileron just short of the tip block, thinking it would prevent damage to the aileron in the event of a tip strike; and I installed a fixed single tow hook, because I thought that using two adjustable tow hooks was unnecessarily complicated and expensive. As you'll see in the next section, one change caused a problem and one didn't.

PERFORMANCE: Constructing a kit gives you time to think, and during construction, I often thought, "This thing is taking me a long time to build and looks pretty weird. I sure hope it flies OK." Well, the time for wondering was over. I hand-tossed the plane into a light wind over a slight downhill slope. It flew well from the first launch: stable, maneuverable and *fast*.

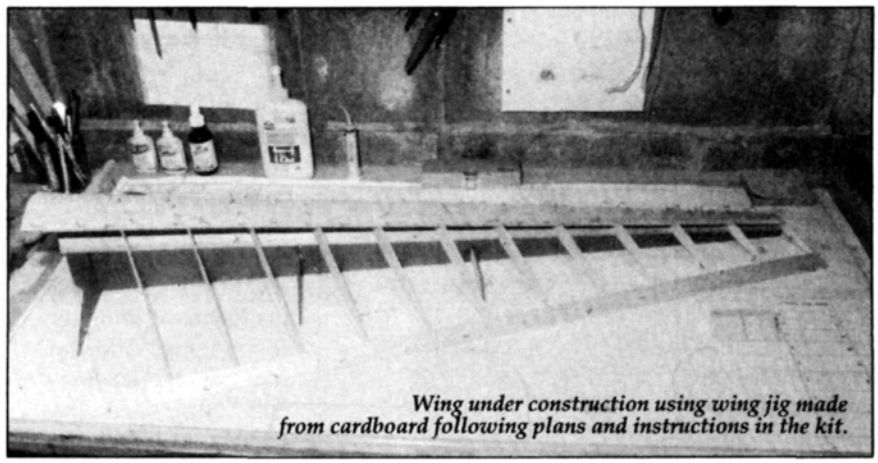
During the first few hand launches, I noticed its slight tendency to dive, but I fixed this by trimming the elevons about 1/4 inch above the wing. *Caution:* If you haven't hand-launched gliders before, you might be surprised at how vigorously they must be thrown to reach flying speed. It's easy to stall a glider on hand launch. With sufficient air speed, my Klingberg Wing is smooth, stable and predictable in flight.

Then it was time for a *real* flight. On a high-start launch, the airplane had a tendency to go sideways on the climb, and keeping it pointed upward required some quick stick work. Release off the line was normal; flight was smooth and *fast*. Like any aileron/elevator (no rudder control) ship, turns are made by coordinating the aileron to roll the airplane and up-elevator to begin the turn. My 11-year-old son flew the airplane for the photo missions, and neither he nor I had trouble controlling it, even during our first flights.

In flight, this bat-like airplane looks spectacular. It's shaped like a B-2 stealth bomber; it's silent (even quieter than other gliders—probably owing to reduced drag); and it flies and turns faster than other gliders I've flown.

With the test flights and some photographs behind us, it was time to explore the limits of its flight-performance envelope. Turns are smooth and can be gentle or tight, depending on the degree of bank and up-elevator cranked in by the pilot. There's some noticeable side-slipping in shallow, banked turns, but this isn't surprising in an airplane with no vertical control surfaces. The pilot quickly compensates for this, and it isn't a problem.

The model performs inside loops smoothly and easily, and, with sufficient altitude, it's capable of outside loops. Forward stalls are gentle and don't produce a tendency to drop a wing tip and spin. Stall turns are possible if your timing is just right. Ready for a Cuban-8? Sorry!—the model isn't capable of rolls.



Wing under construction using wing jig made from cardboard following plans and instructions in the kit.

I was disappointed with the lack of roll capability and concerned about the twitchy climb on high-start, so I wrote to Future Flight. Rollin Klingberg called to answer my questions. He confirmed that the model won't perform rolls and said that it wasn't designed to be fully aerobatic. He pointed out that basic stability and ability to roll are conflicting design criteria in a flying wing, and he chose stability when designing the Wing. He said that adding winglets will reduce side-slipping in turns and that using twin tow hooks will increase stability during a high-start launch.

After this discussion, I added winglets and dual tow hooks, both of

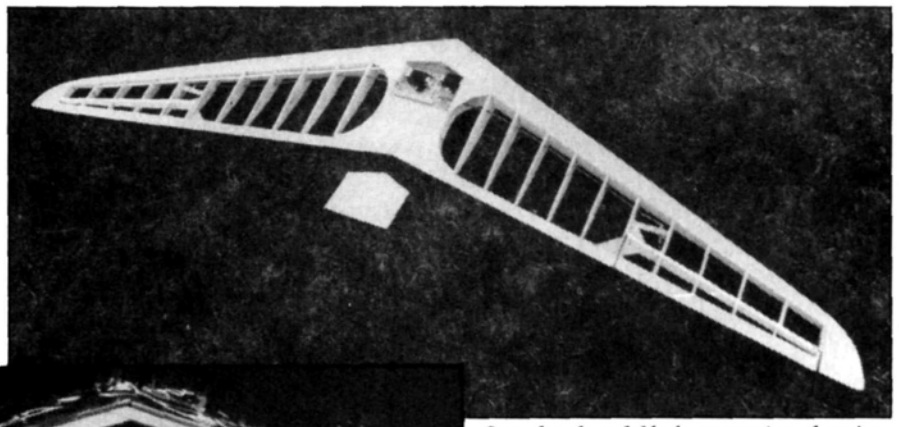
which are mentioned on the plans. The airplane is now quite steady on high-start launching, and it's smoother in the turns. To me, the model is stable enough to be considered an aileron trainer and agile enough to be a slope-soaring pylon racer.

I think this kit is best for intermediate builders and fliers. If you've already built a glider kit, with patience and persistence, you'll be able to complete this one. If you've flown solo with another 2-meter glider, you'll be able to solo with this one. If you've built and flown a few gliders, you'll have no trouble, as difficult construction techniques aren't called for, there are no tricky materials to work with, and you soon get used to the controls.

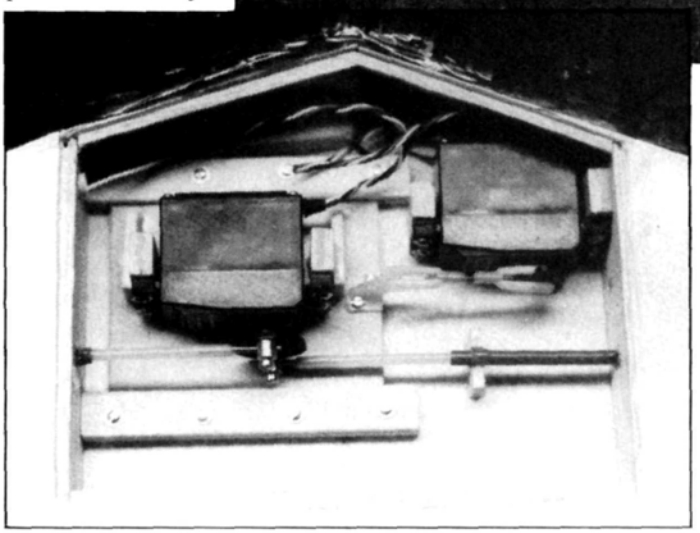
Durability is important to me. My Klingberg Wing has been "dorked" three times: looping in high winds on a slope, trying to roll, and flying into a tree during a photo session. It suffers no more or less damage than other 2-meter gliders I've crashed, and it's no more or less difficult to repair than other balsa-rib-construction gliders I've repaired.

This is my seventh R/C glider, and construction took me 34 1/2 hours during 11 evenings. My building style comes toward the slow-and-deliberate end of the scale, and I'm sure that more experienced builders could complete the airplane more quickly. The only changes I'd make to the kit would be the inclusion of metal clevises and the selection of a harder, albeit heavier, grade of balsa for the leading-edge sheeting material. Again, this kit isn't really easy to build, but it sure flies nicely.

The total cost of constructing the model (based on prices I paid) was less than $60. This includes $40 for the kit; $2.37 for three pairs of Sullivan metal clevises; 98 cents for Du-Bro E-Z Connectors; 49 cents for steel cup hooks (with which I made tow hooks); 49 cents for small screws and washers; and $15.20 for two rolls of MonoKote. Not included in this are the cost of the radio (I used a Futaba* Conquest) and adhesives (I used CA, epoxy and tan carpenter glue).



Completed model before covering, showing shear webs from root to tip, forming a fully enclosed D-tube that makes the wing strong, yet light. Notice that the aileron control horns are internal, and the linkage is almost invisible when the model has been covered.



Radio compartment showing sliding servo/elevon mixing system built according to kit instructions. In case it has to be adjusted, author suggests installing the mechanism with screws instead of glue, and lubricating the slider with wax from waxed paper.

If you have an urge to show up at the slope-soaring site with something different, the Klingberg Wing will do nicely for you.

**Here are the addresses of companies mentioned in this article:*

Future Flight, *12S6 Prescott Ave., Sunnyvale, CA 94089.*

Sullivan Products, *1 North Haven St., Baltimore, MD 21224.*

Du-Bro Products, Inc., *480 Bonner Rd., Wauconda, IL 60084.*

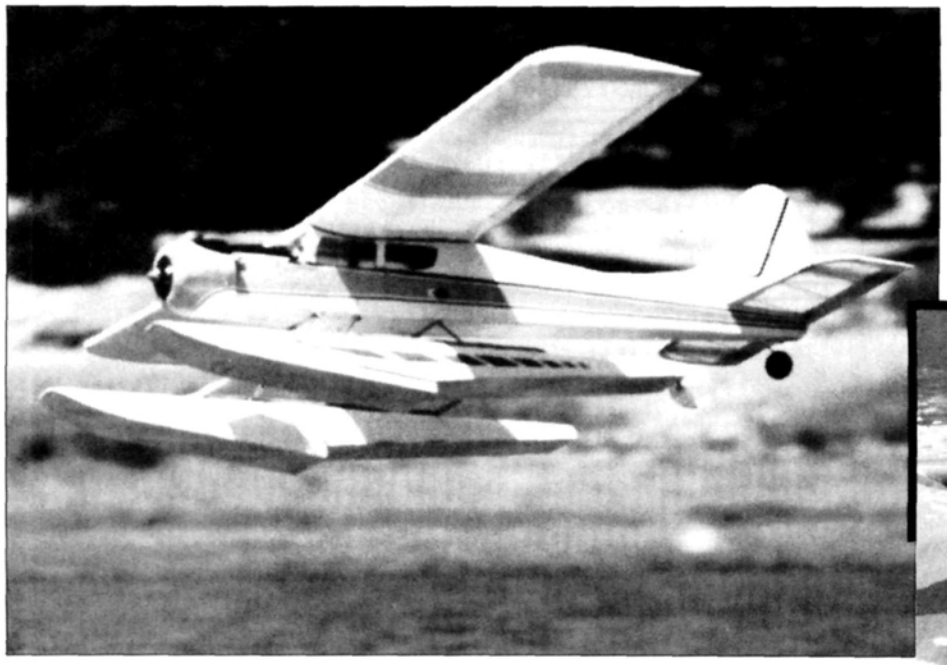
Top Flite Models, *263S S. Wabash Ave., Chicago, IL 60616.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.* ■

Floating Around

by JOHN SULLIVAN

Beaver clones and other things



Left: Jack Kostelick's "Beaverized" Eagle 63 climbs out of a low flyby on 1/3 power. Plane is a solid performer on floats.

Below: Another Beaver convert, this one from a Sig Mark II by Gary Brandenburg. See text for info.

FOR MANY MODELERS, altering a commercially available kit is the first step toward that satisfying pastime of scratch-building, but they often have the misconception that a slight deviation from the plans will lead to certain disaster. Of course, there are some possible pitfalls, like moving the stab so much that you blank out the rudder, but in most cases, minor changes in outline don't affect performance at all, and you'll be really happy with your customized model.

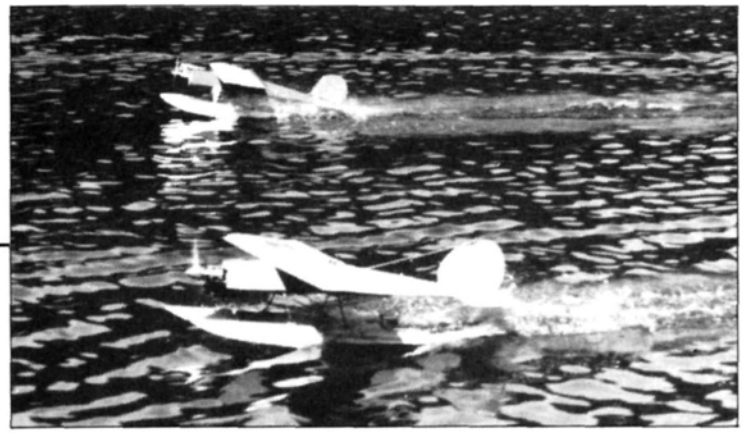
In this month's gallery, there are a few shots of stock kits that have been "Beaverized" by modelers with great results. Jack Kostelick of Dogtown, CA, took a Goldberg* Eagle 63, added a round epoxy-glass cowl made from a Styrofoam plug, changed the rudder and stab outline and came up with what Jack calls a "Beagle." The model is covered with orange and white World-Tex* with black striping, and the overall effect is a great salute to the real Beaver's rugged, bush-plane looks. Jack equipped the Beagle with a pair of sheeted and glassed Sullivan* floats, and he powered it with a K&B* .40.

The author, disguised as a Model Airplane News editor, comes clean in a shocking exposé involving wheels, deception, long summer nights and football fields. See text for shocking details.

The Beagle breaks loose easily and has the same true-flying characteristics as the Eagle 63. On the water and in the air, the plane always seems to be at an ideal attitude, and this builds your confidence. Of late, Jack has been flying the Beagle at one third throttle, very low, with horizontal "8s" and sweeping runs along the shore. The plane is very stable, loses little or no altitude in turns and is absolutely mesmerizing when airborne.

My second example of a modified kit is by Gary Brandenburg of Albion, IA. Gary started with a Sig* Mark II, added a cowl, changed the windshield and window layout and altered the empennage outline to match that of the Beaver. Because of its full body, the Mark II makes an even more striking conversion. I don't have any information on color, but it looks as though the Beaver is covered with olive-drab iron-on with white army markings and insignia. The floats are injected-foam BJs, which I haven't seen advertised for a while. They seem to be sheeted and painted silver and, with simulated non-skid surfaces on the float decks,

(Continued on page 56)



Graff and Lemme's Stiks begin a takeoff run in tight formation. Get down!

they complement the model nicely It looks as if Gary used the stock aluminum gear for his front strut and bent a pair of aluminum strips for the rears, which are attached to the side of the fuselage. If Gary's inside backup is strong enough, I can see that this method would be a boon when setting up the float attitude. If you're "off" a little in your layout, you can move upward or downward. Alumi-

Early morning pit shot at the 1989 Plat I Float Fly. See text for video information.

num angle on the decks and music-wire spreaders complete the gear system.

Turncoat Exposed

The following confession is difficult to make, but my integrity is at stake, so here goes: A couple of months ago, Mike Johnson and I decided to try flying closer to home in the evenings on our local football field, so I had to buy a pair of wheels. I disguised myself as an upbeat East Coast model magazine editor, complete with chiseled good looks, and I walked into Carl's Hobbies in Napa, CA. Everything went well till I reached the cash register and the clerk accused me of posing as Rich Uravitch!

I tried to tell him I was buying the wheels for a friend, but it didn't work. To be serious, I've had a lot of fun with the Leapin' Lena on wheels, and I appreciate the different perspective and the experience it has given me. We tried a few takeoffs from grass, but the little O.S.* .20 4-stroke just couldn't answer the call, and we resorted to hand launching. (Shades of my youth! This is fun, too!) There were some notable differences: I broke the first prop in four years by ramming a fence on landing, and I knocked the rudder off on a 360-degree nose-over on the last landing. On the plus side, the Lena is more agile and speedy, and it makes me feel as if I have two planes.

The landing gear was made to use the same four screw holes as the float gear, and the conversion takes less than five minutes, including hooking up the water rudders. One fact has come to light during this endeavor: As you'd expect, as a seaplane, the Lena flies more slowly than it does with wheels, because of the 1 1/2-pound weight increase. In the lighter wheel mode, flying at a high angle of attack makes the plane fall off to the right or left below a certain threshold. With the weight of the floats below, you can keep feeding in elevator until the plane just staggers through the sky. When all systems fail, it just drops its nose to fly again!

This project has been great fun and a revelation to me, because I've flown only floats for five years. I even almost forgot to re-check the CG after converting to wheels!

Last Train to Havasu

This is being written in August, but it will appear in print at about the time when many of you will head out for the first Schneider Cup re-enactment in Lake Havasu, AZ. Wahoo! I've just received the latest newsletter from Bob Martin, along with entry forms, accommodation information, event regulations, listed race speeds and lots more.

There's also news of the first Schneider model to fly; it's a beautiful 1913 Deperdussin built by Dick Skogland and "Frenchy" Le Blanc. I wish I had black-and-whites to show you. I also received a letter from Ed Westwood describing a Schneider project by Milos, Holcomb and Schultz of the Portland Sky Knights. These guys are building three identical, 18-pound, Macchi M 52Rs with Super Tigre 6000s (the Inline Twin) on ignition! I think I could stand watching these three vying to get around the pylons first. Awesome! Give the meet some thought; there's still time to make plans to attend. Contact Bob Martin*, the event chairman, and maybe we'll see you there!

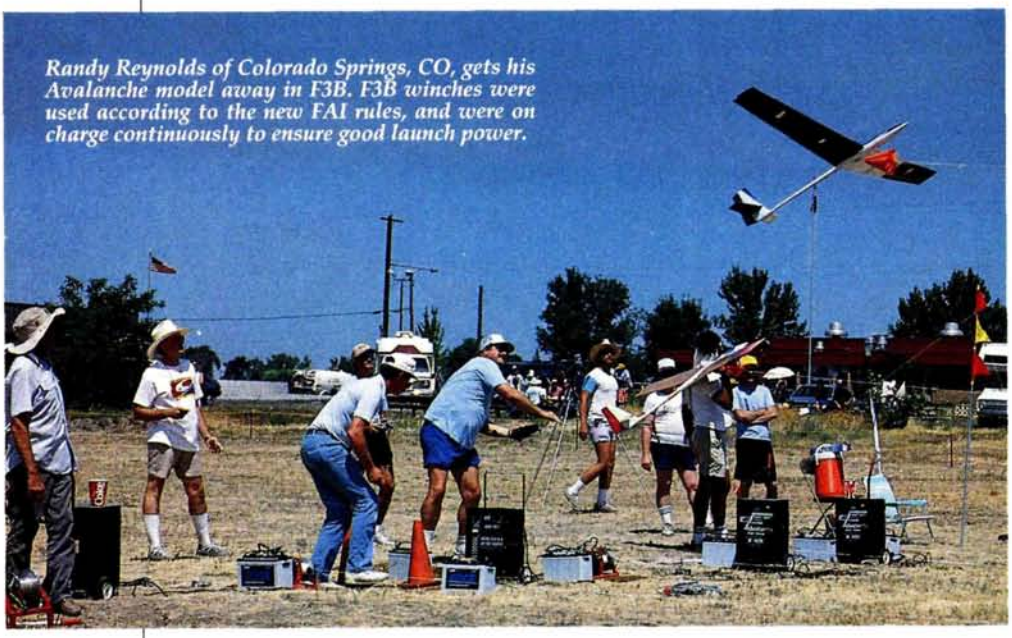
Ugly Duo

Also in the "Floating Around" gallery are shots of Dick Lemme and George Graff with their .60 Stiks on floats. I think George's Stik is by Great Planes, and Dick's is an earlier kit produced by Midwest. Dick's Stik is equipped with a pair of Goldberg 36-inch built-ups, while George rigged his with 36-inch Sullivans. Both have ball-bearing O.S. .60s planted on the front; their performances on the water and in the air are practically identical, and neither has any bad habits.

George Graff and Richard Lemme stare blankly at the author's camera with their O.S. .60-powered Ugly Stiks.

(Continued on page 104)

R/C SOARING AT THE 1989 NATIONALS



Randy Reynolds of Colorado Springs, CO, gets his Avalanche model away in F3B. F3B winches were used according to the new FAI rules, and were on charge continuously to ensure good launch power.

Great weather; great turnout; great flying!

by JOHN LUPPERGER

THE SOARING FRATERNITY had a great time at this year's Nats. The events took place from July 17 through the 22 in the Tri-City area of Washington, which includes the cities of Kennewick, Pasco, and Richland.

Held at three carefully chosen sites, the soaring events included: Slope Racing and Open Fun Fly; Cross Country; Hand-Launch Glider; Scale; F3B; and Unlimited, Modified Standard and 2-Meter Thermal Duration. This article will be an overview of what went on, rather than a blow-by-blow account of each event, or any one individual's performance. (See the Winners' Chart for top-place performers.)

With 389 entrants, this was the biggest Nats soaring event ever, not including the unofficial events. The new format of flying individual events on each day (as opposed to several events each day for several days) made life easier for contestants and officials alike, and I hope this will become standard operating procedure for future Nats soaring events.

I'd heard many horror stories about field problems, poor organization and lack of personnel at previous Nats, and, since this was my first Nats, I really didn't know what to expect. The organizers may not have met all their individual goals, or fulfilled the expectations of all the competitors, but overall, they did one heck of a job. A lot of people worked hard to make this one of the best soaring Nats ever, and if future Nats are as good as this one, I hope to attend them all.

MONDAY, JUNE 17
Slope and Cross Country

Wil Byers, the contest director of the slope-racing and fun-fly events, told me before the Nats that slope soaring in late July was unpredictable in the Tri-City area. For those who arrived early, however, there was a weather front with high winds in the area. The wind blew Saturday through Monday, but on Tuesday, it gave out and put a stop to the racing.

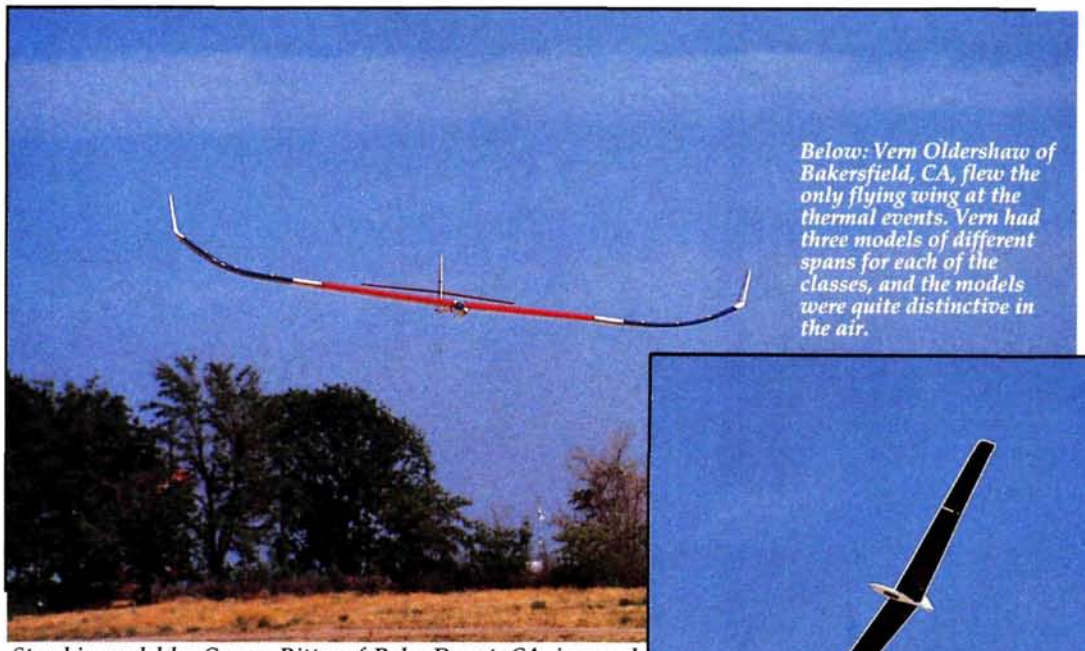
There were two classes of slope racing: one for models with a wing loading of 14 ounces to the square foot or less (15 entrants), and one for models with a wing loading of over 14 ounces to the square foot (10 entrants). The course was 100 meters long, and each contestant flew five laps, 10 circuits between the two flags. The contest was flown according to F3F rules, with one plane at a time on the course, flying against the clock.

It took a couple of rounds

Ed Whyte of Wyoming, MI, modeled his TG-3A after a colorful ship in red, white and blue finish. The model has a 12-foot span and thermals quite well; it maxed both flights!

PHOTOS BY JOHN LUPPERGER

1989 R/C SOARING NATS



Below: Vern Oldershaw of Bakersfield, CA, flew the only flying wing at the thermal events. Vern had three models of different spans for each of the classes, and the models were quite distinctive in the air.

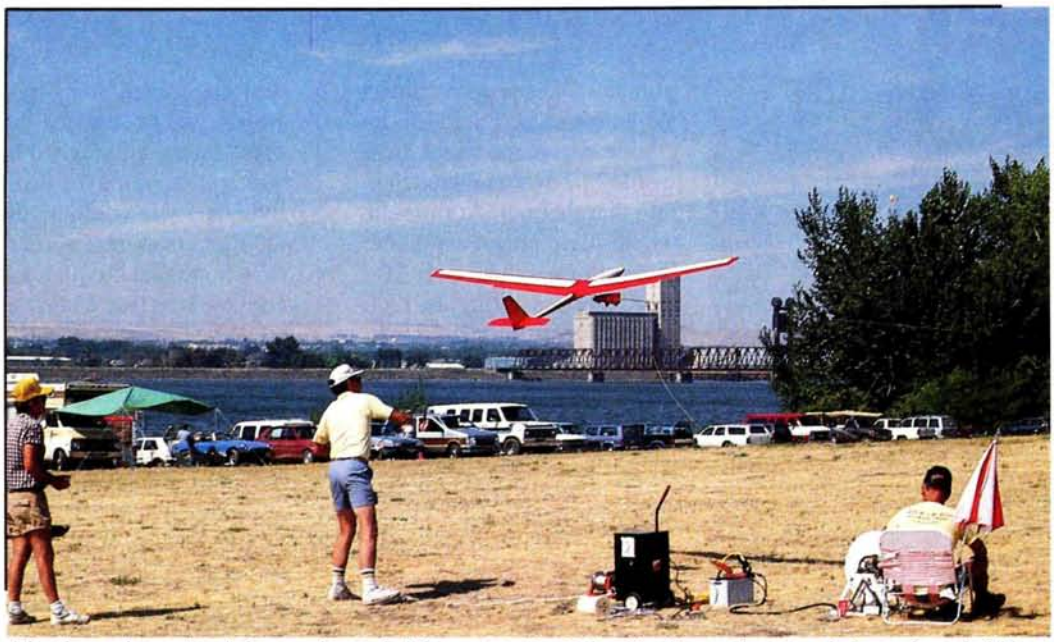
Starship model by George Ritter of Palm Desert, CA, is a real attention-grabber. Elliptical dihedral and tip spoilerons make the Starship one of the more unusual models at the Nats.

of flying the lightly loaded class before the heavies took to the air. These models with heavier loads reach speeds that are really quite impressive, but the fastest model was from the lightly loaded class, which turned the course in a blistering 48 seconds. Not bad, when you consider that the average time in the heavily loaded class was 1:11! The lightly loaded class flew four rounds; the heavily loaded class flew three rounds. It's interesting that the majority of the fastest ships in both classes were similar to F3B models and looked perfectly normal launching from a winch.

Open fun flying was also taking place at the same time. The slope is big enough to accommodate flying events at both ends of the race course without any over-flying or interference. Many modelers brought their favorite sloper, power-scale sloper, or scale glider and enjoyed some great slope flying. This slope site could be the best in the U.S.—the landing area is large enough for a thermal event that has several winches!

Mike Bamberg was the contest director for the cross-

The 1/4-scale TG-2 by Fred China of Vancouver, BC, weighed in at only 8 pounds, with a span of 132 inches. The model looked great in the air, and its blue and yellow military-trainer finish made it very visible.



The thermal soaring sight was located right next to the Columbia River. Shorts and short-sleeved shirts were the order of the day for the entire Nats, and, except for one day of heavy winds, the weather was beautiful.

country event, which took place outside of town on a recreational site made up of three soccer fields. Open desert surrounded the site, which was perfect for cross-country flying. Since I was flying in the lightly loaded class at the slope, I couldn't attend this event. The wind was a problem, and, of the five teams that entered the cross country, only two made it onto the course, and only one was able to finish. Nature is often unkind to the competitor.

TUESDAY, JULY 18
Hand-Launch Glider

Contest Director Bob Nelson oversaw the 29 entrants in the hand-launch glider event. The weather was beautiful, and five rounds were flown before the lift and the competitors gave out. The event, held at the same field that hosted the cross-country the day before, consisted of seven launches, with 2-minute maxes within a 10-minute slot. The pilots' best five flights counted for accumulated time (no man-on-man scoring). A final launch could be made right up to the last second of the slot and completed up to the 2-minute max, and this made a perfect round of five maxes possible.

The lift was excellent, and two competitors actually recorded perfect rounds. Almost every flight group was blessed with lift, and many 2-

Erik Eiche of Vancouver, BC, built his Grunau Baby 2B at 1/4 scale. At a span of 134 inches, it weighed a remarkable 6 pounds, and it's amazingly light, considering its size and simulated plywood-finished fuselage and wing.

The TG-8 by Gene Cope of Yakima, WA, is so realistic in flight, it's hard to distinguish it from the real thing. Gene drew the plans at 3.75:1 for a 9-foot span, a 2,000 square-inch wing area and a loading of 18 ounces to the square foot.

WINNERS

SLOPE RACING

Lightly Loaded:
1st Daryl Perkins
2nd Terry Edmonds
3rd Tony Martin

Heavily Loaded:
1st Daryl Perkins
2nd Tony Martin
3rd Kevin Gibben

Scale:
1st James Veillard
2nd Terry Edmonds
3rd Robert Elliot

F3B:
1st Don Edberg
2nd Larry Jolly
3rd Joe Wurts

HAND-LAUNCH GLIDER

1st Joe Wurts
2nd Tony Martin
3rd Larry Jolly

UNLIMITED THERMAL DURATION

Junior:
1st Rob Edson
2nd Blayne Chastain
3rd Luis Mungia Jr.

Open:
1st Troy Lawicki
2nd Larry Jolly
3rd Dave Banks

Senior:
1st Daniel Hesselius
2nd Jeff Seaborn
3rd Matthew Coleman

STANDARD THERMAL DURATION

Junior:
1st Blayne Chastain
2nd Luis Mungia Jr.
3rd Benjamin Owens

Senior:
1st Shawn Mulligan
2nd Jeff Seaborn
3rd Matthew Coleman

Open:
1st Larry Jolly
2nd Orie Adcock
3rd Robert McGowan

2-METER THERMAL DURATION

Junior:
1st Lee Alley
2nd Hector Moya
3rd Blayne Chastain

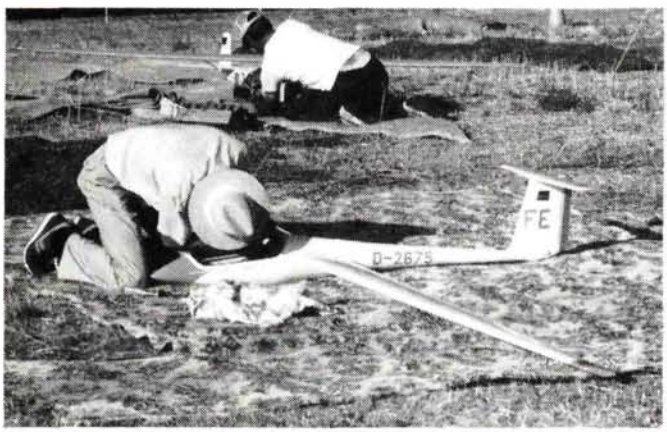
Senior:
1st Shawn Mulligan
2nd Matthew Coleman
3rd Robin Olsen

Open:
1st Dave Banks
2nd Terry Edmonds
3rd Joe Wurts

1989 R/C SOARING NATS

Daryl Perkins with "fast" Eliminator II. Notice the expanse of the valley in front of the slope site. The Eliminator II flew in the lightly loaded class, but turned the fastest time of 48 seconds.

One of the more unusual models at the slope was "Tut," by Bruce Taylor. The forward-swept wing flew nicely at 40 ounces. With 15 degrees of sweep and using an Eppler 182 foil, the Tut was aerobatic, yet stable.



One of many beautiful "glass slippers" that were present for scale. Terry Edmonds looks as though he's ready to crawl inside his DG 300, 4-meter model. These big models are really impressive and thermal quite well.

minute maxes were recorded. When someone found lift, everyone else in the flight group would run over and launch into that thermal. At times, a whole flight group would be in one thermal with only 30 or 40 feet separating the highest and lowest models. This was one of the most exciting events at the Nats, for both the competitors and the spectators. Until you've tried HLGs, you just don't know what you're missing.

WEDNESDAY, JULY 19
Scale and F3B

Scale, the beauty event of soaring, and all the remaining soaring events were coordinated by Soaring Events Director Tom Culmsee. The 17 flying entries included a variety of models ranging from replicas of the '30s to modern glass ships.

The thermal soaring site was an open field of weeds and grass. Tom had the entire field roughly mowed, with extra mowing done in the landing area. Indoor/outdoor carpet was laid out for ROG takeoffs and in the landing area. The majority of the scale ships did ROG, and it was really something to see.

Scale judging took place on Tuesday, and the top eight aircraft were only five points apart. The flight task was to stay aloft for 3 1/2 minutes simple duration and then land within a 100-foot circle. When it was all over, only 17 points separated the top five positions; a very close battle all the way.

The majority of the scale competitors didn't seem that concerned about winning or losing. Most likely, they came out to proudly show off and share their beautiful creations. Watching these ships rise majestically on the winch, break free of their earthly bounds and soar...well, it's almost impossible to describe. In many cases, all you had to do was squint your eyes just a little, and you could hardly tell them from real aircraft. I only hope that the pictures convey their true beauty. (I apologize to the owners of all the gorgeous glass ships for losing the roll of film with them on it. Sorry!)

The F3B event followed the scale and took place at the same site. There were 25 entrants, including one Senior and three Juniors, and this made it one of the best turnouts at a Nats for F3B. Although the majority of the models flown were thermal-duration types, most of them had ailerons and would make good candidates for Sportsman Multi-Tasks events.

The supplied winches were FAI-legal and, with the new rules, they probably weren't as strong as those used during the regular Nats events. Because of their clean design, strong construction and launch technique, the true F3B ships still out-launched the more conventional models. When one of the hot-shot F3B fliers put in a fast speed, everyone paid attention. There were a few runs in the low 20s, which is comparable with what's being done in Europe. Interest in this type of flying appears to be gaining in popularity.

THURSDAY, JULY 20
Unlimited Thermal Duration

With 126 entrants, the Unlimited had the biggest turnout of any soaring event. There were eight Juniors, four Seniors and 114 Open contestants. This and the remaining thermal-duration events were run as a standard AMA contest. Flight tasks were 7 minutes precision duration, with in/out

landings worth 100 points. The first round of each day lasted 5 minutes to allow for the poor air that's usually found early in the morning. It's a real shame that we had the worst weather on the day of the biggest single event of the Nats. The wind was bad, and from the beginning of round one to the end of round four, it only got worse.

The thermal field was bordered on one side by a row of tall cottonwood trees and the Columbia River. The wind blew from this direction, starting out at 10 to 15mph, quickly increasing to 15 to 20mph, and then up to 20 to 25-plus mph. This killed thermal lift shortly after the first round began, and the only way to make time was to slope-soar the row of trees on the river side. To the credit of many good fliers, they were actually able to do this, often spending as much as 5 minutes of a 7-minute flight only a few feet above the treetops. There was one fly-off to determine 8th and 9th places. The sad thing about these conditions is that many aircraft were destroyed during launching and off-field landings. The organizers did all they could to keep things running smoothly, and for the fourth round, they abandoned the retrievers to speed things along. The fliers then pitched in and retrieved a line after they completed a flight. A wonderful spirit of cooperation saw us through the day.

FRIDAY, JULY 21
Modified Standard Thermal

What a beautiful day! No wind, blue skies and just enough clouds to ensure good lift. Standard had 103 entrants, with eight Juniors, six Seniors and 89 0pen contestants, and five rounds of competition were flown. With the lift cycles quite long and numerous, this was the day for thermals and fun. Many pilots made their time, or came very close, and ships were skying out throughout the day.

SATURDAY, JULY 22
2-Meter Thermal Duration and Awards Banquet

The 2 Meter had 103 entrants, with ll Juniors, seven Seniors and 86 0pen contestants. This is my favorite event, as all contestants fly ships of fairly comparable size. Like Friday, there was lots of good lift and many competitors made their times. The competition was quite intense, and there were fly-offs to determine 2nd and 3rd and 8th and 9th places. The fly-offs were very exciting, with simultaneous launches and close flying right up to the last second.

Saturday night we all gathered at the Shilo Inn in Richland for a great buffet dinner and the awards presentations. Many great-looking trophies were handed out, and some great hangar flying took place, as everyone recapped their best flight of the Nats.

The guest speaker was Dr. Paul MacCready of Gossamer Condor and of Gossamer Albatross fame. He held everyone's attention during his very interesting talk, slide show and film presentation, and I think everyone was a bit surprised by his great sense of humor, as well as his *real* motive behind his venture into human-powered flight. (It seems bank-loan officers can provide great motivation for seeking cash prizes!)

This event may have been the best soaring Nats ever, and the individuals and groups responsible for it can take real pride in a job well done. They can take pride in the facilities they provided; in their organization of the events; and in a new, workable format. They can take pride in themselves for an effort that will be long-remembered and appreciated by all who attended. To the individuals responsible, to the North West Soaring Society, to the Portland Area Sailplane Society and to the Tri-City Soarers—Congratulations! ■

If any one group can claim to have had the most fun at the Nats, it's probably the hand launchers. Win, lose, or crash, this bunch had a ball!

Beautiful scale Schweizer met its end on the winch. In a crash, scale models don't fare as well as regular thermal models.

The fun fly at the slope brought out all kinds of models. Hal Weber's F-82 is something to see. With a span of 84 inches, area of 1000 square inches, flying weight of 11.5 pounds and a wing loading of 26 ounces to the square foot, it's a real attention-grabber!

ENGINE EVALUATION

ZENOAH QUARTZ G-23

A small, economical, gas engine for those large, lightweight 1/4-scalers.

THIS SMALL, SMART industrial engine has received the earlier attentions of World Engines* in the form of the Zenoah Quartz G-23, and, more recently, of Toni Clark of West Germany, who has given his conversion the name Titan ZG-22. The *real* name of the engine should probably be that of the original maker, as shown on the crankcase of this test engine: the Kalt E G-22. This engine is part of a blower unit produced by Komatsu Zenoah of Japan.

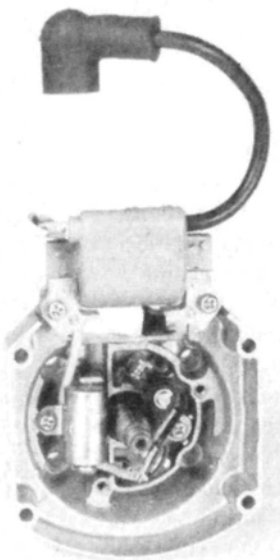
Its layout is one frequently adopted by industrial manufacturers: 2-stroke, Schnuerle-ported, single-cylinder, air cooled, magneto flywheel spark ignition, and a burning gas mixture supplied by the very efficient Walbro diaphragm pumper carburetor. At 22.5cc, its cylinder capacity is one of the smallest, and it's easy to see why different numbers have been used in its names.

The Titan has a longer propeller driver than the World Engines Zenoah engine (43mm compared with 29mm from cylinder to prop face), and it's also equipped with the standard industrial muffler. In other respects, the engines are similar.

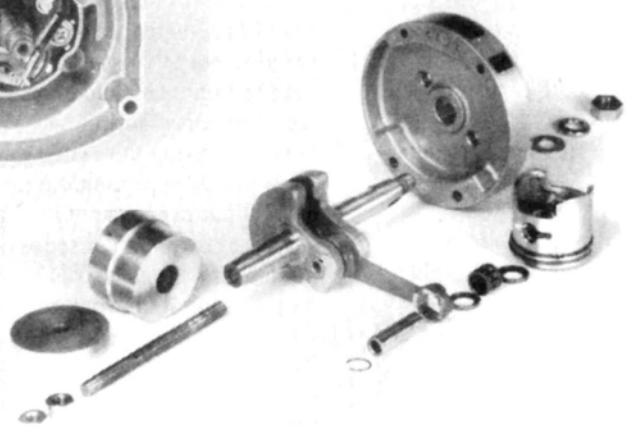
Certain engines have been available with a built-in gearing reduction and recoil starter, but I've had no direct experience of this version. The engine for this review was supplied by World Engines.

The existence of these conversions points to some degree of dissatisfaction with the "real" model engine, and, certainly, the magneto spark ignition, gas fuel and the pumper carburetor operating at any distance from the fuel tank under all maneuvers, are attractive to many large-scale aircraft modelers. Mechanically, too, the usual provision of needle or ball bearings throughout the engine gives a reliability that's difficult to match, and, of course, this is required in industrial applications. Compared with the few large-capacity single-cylinder model engines available (Super Tigre 20/45cc; OPS 30cc; Tartan 20cc), however, the industrial conversion usually has a lower power-to-weight ratio, because the large magneto flywheel and carburetor are weight penalties, while the usual induction systems employed for simplicity and reliability often inhibit specific power output.

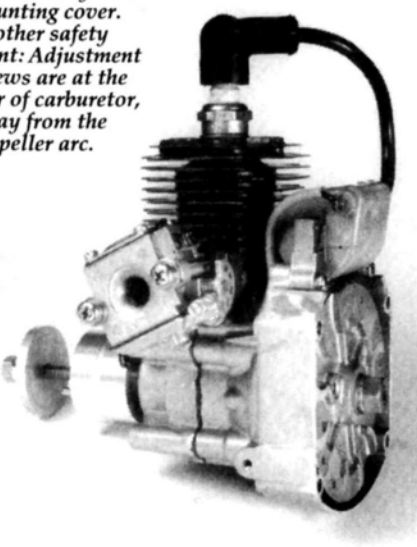
These features usually put these conversions in a sport rather than a competitive arena, so for a typical, light, 1/4-scale model aircraft weighing about 14 pounds, the Zenoah G-23 is a very practical power unit. Its



Standard, contact breaker ignition hides snugly behind flywheel (removed for photo). "Kill-switch" grounding terminal is at top left of coil, with high-tension lead exiting from top right.



Steel connecting rod has caged roller races at crankshaft and wristpin ends. The crankpin is pressed into the crankwebs, so it isn't serviceable by normal users. Note the magnets in outer face of flywheel—these generate high-tension spark when traversing across the face of high-tension coil.

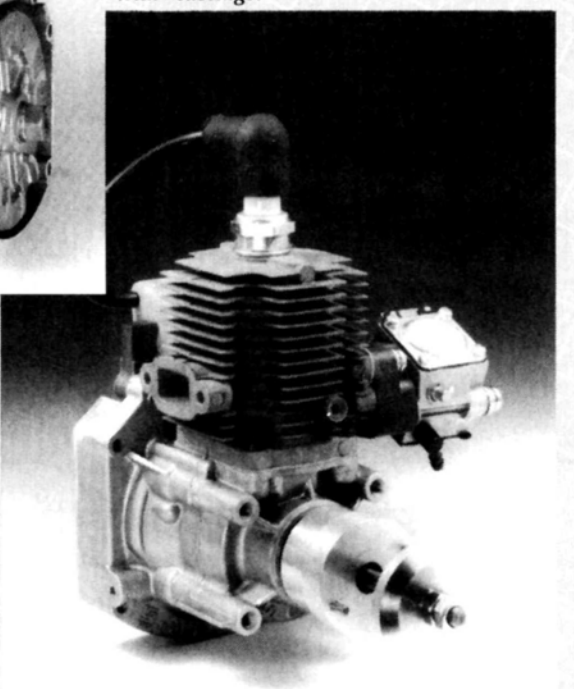


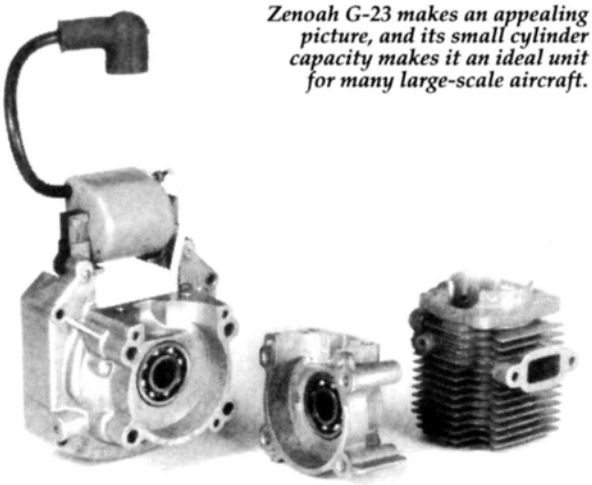
Flywheel is sensibly hidden away behind mounting cover. Another safety point: Adjustment screws are at the rear of carburetor, away from the propeller arc.

considerable attractions have also given it a significant place in the 1/4-scale model car world, and where the absence of fuel regulations allows it to be operated at higher power levels than those recorded here on gas.

Following a dynamometer test and a strip-down, the test engine seems destined to power one of my craft because it seems to be one of those engines that grow on you. After years of trying to get just the right amount of current for glow plugs out on the field (not one of my strong points!), being able just to turn up and crank the propeller has considerable appeal, and, incidentally, this points to one of the hazards of these engines: They *can* start easily without much preparation at all, so take care that young children or ignorant people don't try to do just that (imagine the disastrous results). The use of a "kill switch" would perhaps prevent this, but such things are left in the "on" position occasionally.

Crankcase halves are accurately located together by dowel pegs. High-quality "industrial" castings.



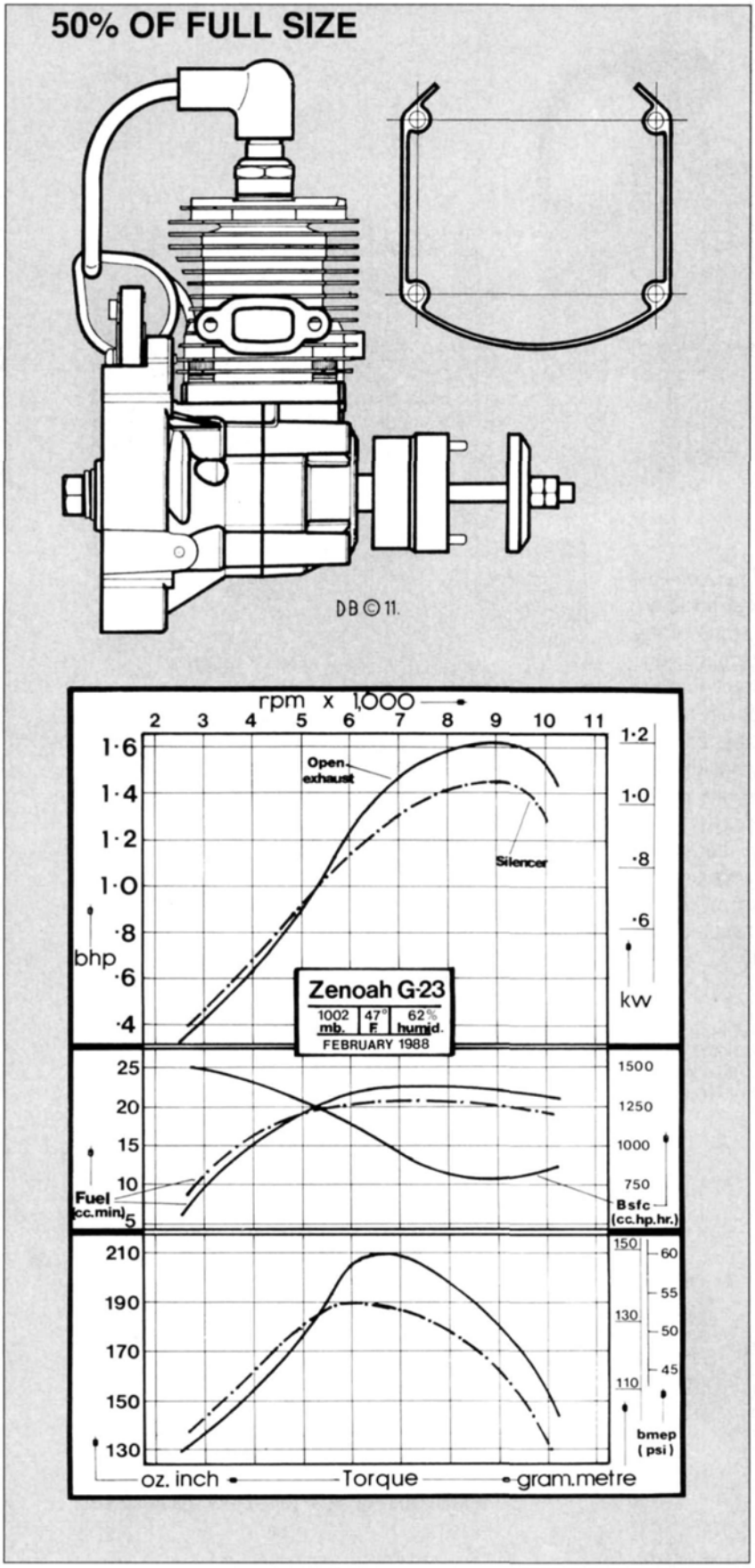


Zenoah G-23 makes an appealing picture, and its small cylinder capacity makes it an ideal unit for many large-scale aircraft.

Mechanical Points

Another difference between the industrial engine and the typical model engine is the combined one-piece cylinder and head, which is internally chromed directly onto the aluminium alloy. The crankcase is split vertically to receive the single-throw twin-webbed crankshaft. The expected longevity of the needle roller at the crankshaft end allows the crankpin to be pressed very firmly into both webs, so this crank assembly can't be serviced by the average user.

The wristpin end of the cast-steel connecting rod also uses a caged-needle roller bearing, and the absence of any model-style plain bearing in this engine allows the use of between 2 percent and 5 percent mineral oil in the gas fuel. The low effective compression of this engine (6:1) means that quite a low-grade gas can be



used, but, for this test, I used a top grade (as long as there's no "pinging" or detonation, power output hasn't been affected). At the front, model-style twin ball bearings are used to support propeller or drive loads, and a single ball bearing supports the rear crankshaft, which drives the flywheel magneto. In the industrial version, the end bearings are oil-sealed for a clean exterior.

An attractive feature of the Zenoah is that it has the relatively dangerous flywheel neatly hidden behind and within the built-in radial mount, and in the two conversions, the dangerous cast-in cooling vanes have been removed for additional safety.

Power Test 1

Open Exhaust: Fuel: top-grade gas with 5-percent high-quality Marine 2-stroke mineral oil; NGK BMR 7A plug.

Initial break-in was done with the various propellers listed, and rpm did increase a little after a half-hour running. Its general mechanical design and usual industrial use means, however, that the engine is really ready to run almost immediately. (After all, how often do we hear of a chain-saw operator carefully graduating the break-in period of his new machine?!)

At large loads and low rpm (below 3,200), the Zenoah would only keep running if the throttle was half closed to keep the carburetor's air velocity high.

Thereafter, torque figures rose significantly from 4000rpm up to 6700rpm, where the maximum figure of 210 ounce/inches (1.5 Newtons) was reached. Final maximum hp of 1.61 (1.61 PS) was attained at 9000rpm. Beyond 10,200rpm, torque decline became so marked that further moves up the rpm scale became counterproductive, probably owing to the combination of restricted induction timing and the fixed ignition timing, which is almost certainly optimized for the 6000-to- 9000rpm band.

Power Test 2

Super Tigre 2000 muffler: Fuel: same fuel/oil mixture as in Test 1.

No muffler had been provided by World Engines, so an Super Tigre expansion muffler of an appropriate size was pressed into service. At higher rpm, this restricted torque in the usual way, but it

SPECIFICATIONS

Capacity:	1.374 cubic inch (22.52cc)
Bore:	1.260 inch (32mm)
Stroke:	1.102 inch (28mm)
Stroke/bore ratio:	.875/1
Timing periods:	Exhaust - 144° Transfers - 110° Sub-piston Induction - Opens 120° ABDC - Closes 60° ATDC - Total 120°
Exhaust port height:	Exhaust blowdown period - 17°
Port height:	.344 inches (8.76mm)
Combustion volume:	3.1cc (spark-plug cavity of .5cc included)
Compression ratios:	Geometric - 8.26/1 Effective - 5.99/1
Cylinder-head squish:	.060 inch (1.55mm)
Squish-band angle & width:	Shallow trumpet shape
Crankshaft diameter:	.472 inch (12mm)
Crankpin diameter:	.394 inch (10mm)
Crank-end eye diameter:	.544 inch (13.84mm)
Crankshaft nose thread:	.6mm x 1mm
Wristpin diameter:	.3145 inch (8mm)
Wristpin-end eye diameter:	.433 inch (11mm)
Connecting-rod centers:	50mm
Carburetor bore:	.373 inch (9.47mm)
Mounting holes:	78mm x 55mm x 4mm holes
Height:	5.4 inches (137mm) - to top of cylinder
Length:	4.45 inches (113mm) - back of mount to prop driver
Width:	5 inches (127mm) - including carburetor
Frontal area:	18 square inches (116 square cm)
Weight:	Overall - 2 pounds, 14 ounces (1.3 kilo) crankshaft assembly and connecting rod - 6.9 ounces (196 grams) piston - .85 ounce (24 grams)
Performance:	
Max. BHP:	1.61 @ 9,000rpm (open exhaust) 1.45 @ 8,900rpm (silencer)
Max. torque:	210 ounce inches @ 6,700rpm (open exhaust) 190 ounce inches @ 6,100rpm (silencer)

RPM on Standard Propellers:	**Open Ex.**	**Muffler**
24x8 Zinger	3,501	3,552
22x8 Mastro	3,685	3,748
18x7 Mastro	5,912	5,846
20x6 Zinger	6,410	6,274
18x6 Graupner (wood)	6,961	6,851
16x6 Airflow	8,557	8,338
15x8 Graupner (nylon)	8,560	8,357
16x5 Zinger	8,789	8,595

Performance Equivalents	
BHP/cubic inch	1.17
BHP/cc	.071
Ounce inch/cubic inch	152.8
Ounce inch/cc	9.32
Gm. metre/cc	6.66
BHP/pound	.56
BHP/square inch frontal area	.089
Manufacturer:	Komatsu Zenoah, Japan
US Distributor:	World Engines

did give a slight boost below 5000rpm.

Of continuing interest is that the fuel efficiency curve (BSFC) again showed superior results at near to the maximum EP point, whereas a fully optimized engine usually reveals best efficiency near to the maximum *torque* point. Like most model glow-plug engines, this Zenoah G-23 is therefore probably affected by a fixed ignition point that tends to reduce low-speed efficiency—a fact revealed by the torque curves themselves. The implication is that, as fixed here at approximately 20 degrees BTDC, the ignition timing is really too advanced for very low-speed running, and it might be detrimental to run the engine for too long with large propellers giving rpm below, say, 5500 at full throttle. No doubt, skilled engineers out there could modify the contact-breaker mounting to allow some movement of the timing, but for all normal use, the timing, as fixed, is a good compromise for modelers.

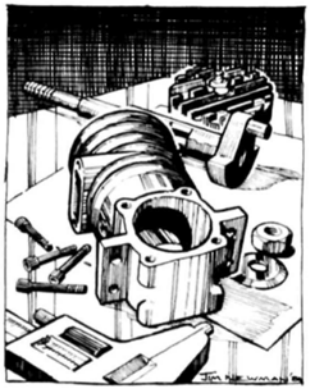
To ensure that low-speed hand-starting gives sufficient voltage to the spark plug, the flywheel magnet-to-coil gap should be kept small (.012 inch or .3mm).

As always, the Walbro carburetor performed faultlessly throughout the test, and adjustment of the idle screw allowed easy slow-speed running down to 1200rpm on a 20x6 Zinger prop. Throttle response was equally sure and swift.

Summary

In modelling terms, the Zenoah G-23 is an appealing unit that combines the advantages of spark ignition, good carburetion and long-term, trouble-free running, in a conveniently shaped, smaller package than many industrial conversions. Reports suggest that its justifiable popularity is increasing, so perhaps we should now expect problems with *supply!*

**Here's the address of the company featured in this article:*
***World Engines,** 8960 Rossash Ave., Cincinnati, OH 45236.* ■



About Those Er

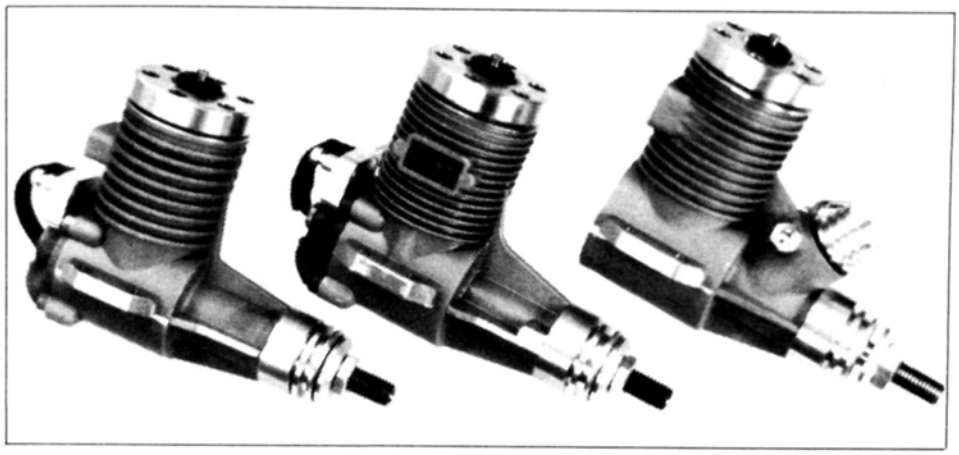
by JOE WAGNER

Horsepower, Useful Power and Thrust

WE OFTEN SPEAK of our model airplane engines as "powerplants," and this term nicely describes what model motors are intended for: sources of power to propel our miniature aircraft in flight. Many R/C fliers, however, seem uncertain about what exactly "power" refers to in discussions of the performances of their model motors.

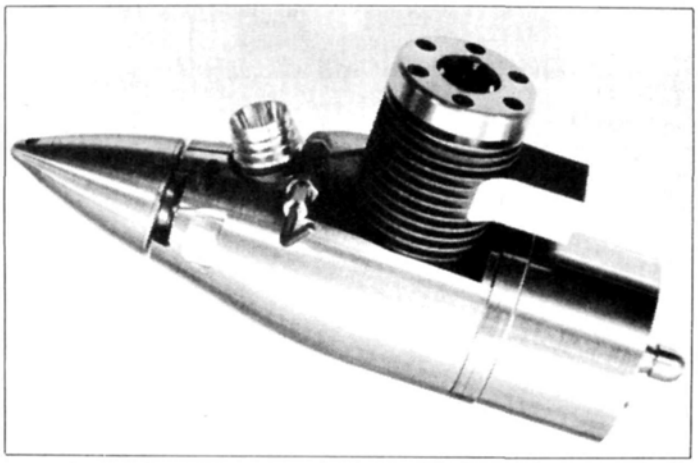
The unit of power most commonly used to evaluate internal-combustion engines is the *horsepower*. One horsepower (hp) is the energy required to lift 550 pounds 1 foot in 1 second. This is a "linear" mathematical relationship: 1 hp will also lift 1 pound 550 feet in 1 second, or 275 pounds 20 feet in 10 seconds, and so on.

To find the horsepower of a model engine, the values just given can be expressed in a more useful form, as a multiple of "torque" (the twisting force available at the engine crankshaft) and rpm. The formula is: hp equals torque (in inch-pounds) multiplied by rpm divided by 63,025. From this, it's obvious that horsepower rating depends on both torque and rpm. Increase either, and the hp goes up; decrease either, and the rated horsepower goes down. As I'm sure you've noticed, however, there's nothing in the engine horsepower formula that involves propeller thrust! *Any* sort of propeller, even a very poor one, will produce the torque and rpm values from which a hp rating can be calculated, but because it's only the prop, or ducted fan, that pulls the airplane, "rated horsepower" (sometimes called "brake horsepower") is of far less importance to model performance than propeller thrust, as I'll explain in a moment.



A selection of Nelson .15 glow engines in current production—probably the most powerful model motors for their size being made anywhere in the world.

Most people don't realize it, but today's model motors are the most powerful internal-combustion engines in the world for their size and weight. As a comparison, the turbocharged 2-liter engine of a 1990 Plymouth Laser puts out 190hp, but if it developed the power for its displacement of a 1989 Nelson* .15 competition glow engine, it would produce over 250hp! Considering power in terms of engine weight: The elusive goal of designers of full-size aircraft racing motors (such as were used in world speed record competition) was 1hp per pound of gross engine weight. The Nelson .15 produces almost *twice* that!



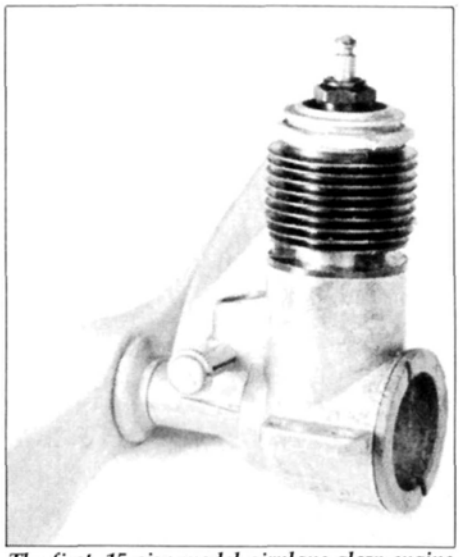
A mighty sleek mounting setup for the world-class Nelson .15, this all-metal assembly was designed for free flight, but it would work just as well for a red-hot R/C racing airplane.

Of course, there's a price to be paid for all this available power; several prices, in fact. Fuel for our model engines is expensive, and glow engines gulp it greedily. To gain high hp, model motors are usually run at quite high rpm. (The aforementioned Nelson .15 turns up 14,000, and some of the small Cox engines readily surpass 24,000.) This high model-engine rpm produces excessive sound. This noise is at a pitch and volume that's particularly bothersome to non-modelers, and it has caused the loss of *many* model flying fields over the past decade or two.

It's possible, however, to fully enjoy the benefits of the increased power output of modern glow engines without suffering the penalties just mentioned. Today's high-performance R/C model motors are as useful at lower rpm as they are at "shrieking" level. At maximum speed, torque goes down because of in-

creased frictional losses and decreased "breathing time." Thus, lower rpm is compensated for by greater torque, and the net power output doesn't change much.

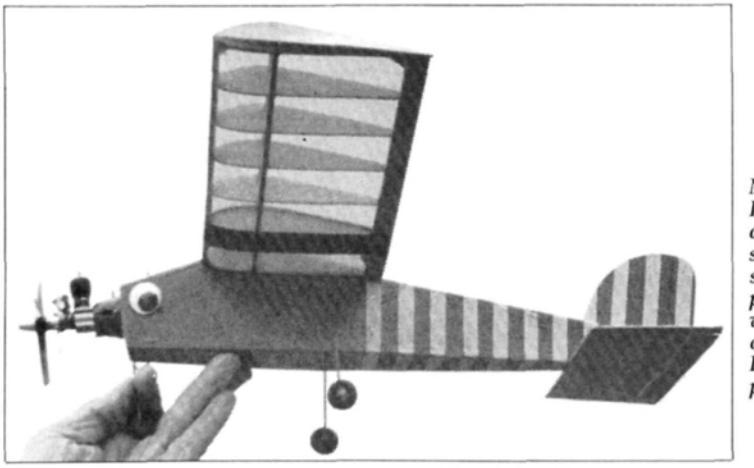
A good illustration of this effect—and of the progress in model engine design during the last 40 years—is my old pal George Aldrich's experience at last February's Vintage Stunt Meet in Los Angeles, CA. (U-Control models provide a particularly accurate way of comparing the in-flight performance of miniature engines, because their air speed is so easy to measure.) For the VSC contest, George



The first .15-size model airplane glow engine was the 1952 OK Cub .149. Modern racing .15s develop over eight times its power!

installed a modern O.S. .35 in a replica of his original 1951 Nobler. His first Nobler used a Fox .35 and flew at about 7 seconds per lap, but the O.S.-powered replica turned 5.2-second laps, with the engine running as rich as George could set it! George says, "I never dreamed the O.S. had so much power!"—and he's one of the world's foremost engine experts.

I was just as surprised as George. After all, there doesn't seem to be a great deal of difference between the design and construction of the new O.S. .35 and the



Nick Nixon's tiny R/C Bumblebee owes much of its success to its small, fast-revving prop, because it wastes a great deal of the hot Cox Tee Dee .020's high power output.

'51 Fox of the same displacement. Yet the new engine develops over 40 percent more "useful power," and that's the key term: *useful power*. Competition fliers have known for many years that big props turning slowly develop more thrust than tiny ones spinning at maximum rpm. Regular features at the AMA Nationals held at U.S. Navy air bases in the '50s were impromptu tug-of-war matches between engine-powered models. Competitors would tie two airplanes, tail to tail, adjust their engines for maximum "go," then release them and see which model would outpull the other. I found it mighty educational to watch a screeching McCoy .19 Redhead racing engine being hauled backwards effortlessly by a mild-mannered sideport Ohlsson .23.

Racing engines employ small-diameter propellers primarily in order to turn high-pitch props fast. After all, maximum air speed is the product of a prop's pitch multiplied by its rpm, multiplied by its efficiency. A larger propeller with a flatter pitch will develop much more static thrust than a smaller one with a coarser pitch. Even at 100-percent efficiency, however, a 4-inch-pitch prop at 9,000rpm couldn't possibly move its airplane through the air any faster than 34mph (3,000 feet per minute). You can't set speed records that way! To go fast, there's no substitute for a high-pitch prop, regardless of efficiency losses.

Propeller efficiency is still important, though. Take a .40 ABC Schneurle that's rated at 1hp. In a 6-pound R/C model with reasonably low drag, that much power, if fully usable, could haul its airplane vertically upward at approximately 45mph. It would go out of sight, straight up, in 15 seconds!

No .40-powered R/C airplane I've ever seen could perform like that, but it isn't surprising. Model propellers do very well indeed if they can convert as much as 70 percent of their engines' horsepower into useful thrust. Most props used on R/C airplanes probably waste half or more of the power that spins them.

I saw a good example of this at this year's AMA National Fun Fly at Wright Field. A tiny Cox Tee Dee .020-powered R/C model by F.H. "Nick" Nixon from Louisiana entertained all who saw its aerial antics. The model was only about 1 foot long overall, with a span of 16 inches. Now, the Cox .020 Tee Dee is a mighty potent powerplant for its size, producing very nearly the same hp as the reed-valve .049s. I once had one in a 4-foot-span powered glider, and I found the Tee Dee to be too much for it. My glider climbed too fast and too high on a tank of fuel.

Yet Nick Nixon's model, one third the size of mine, flew really well. It was quick, but not blindingly fast, and, even without any provision for throttling, Nick's airplane didn't seem to climb excessively. Why? Because Nick had a tiny three-blade plastic prop on the .020 Tee Dee! By so doing, Nick deliberately

(Continued on page 107)

SPORTS AVIATION

EXTRA 230-40

by CHRIS ABATE

SPECIFICATIONS

Type: *Sport-scale aerobatic*
Span: *55¾ inches*
Weight: *6 pounds, 1 ounce*
Area: *542.5 square inches*
Wing Loading: *25.8 ounces per square foot*
Power Req'd: *.40 to .45 2-stroke; .60 to .90 4-stroke*
No. of Channels Req'd: *4*
Suggested Retail: *$320*
Features: *Ninety-percent complete; full hardware package; engine mount installed. You only need to buy engine and radio. Model needs no painting! Full decal sheets.*
Comments: *A very aerobatic, good-looking aircraft that's a great flier.*

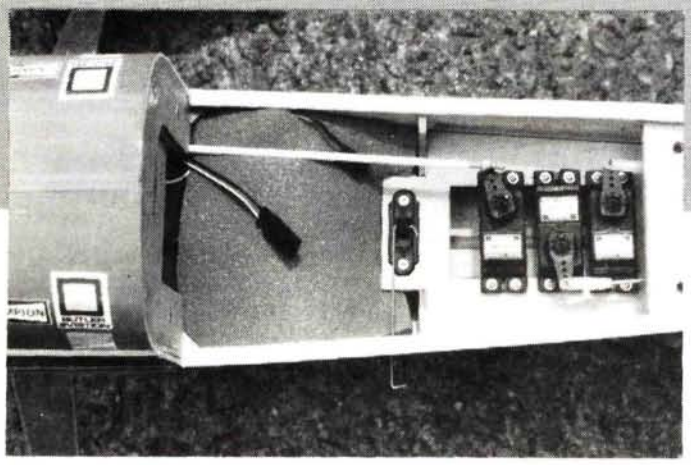
PHOTOS BY CHRIS ABATE

Colorful, smooth-flying ARF version of Mr. Extra's world-class performer

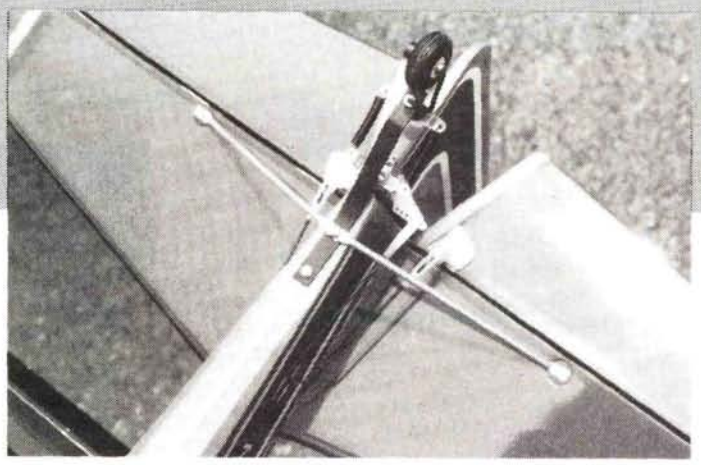
IF THIS IS your first exposure to the Sports Aviation line of EZ kits distributed by Global Hobbies*, you'll find them interesting: If you refer to the drawing, you'll get an idea of the underlying construction of an EZ kit, which consists of a basic airframe (a conventional wooden structure) that's covered by a foam layer and then a paper layer. If a scale plane, the paper is printed to match the particular color scheme of the aircraft; if not scale, the paper usually has a very colorful design. The final layer of covering is a protective, clear, fuel-proof plastic sheet.

The EZ line of kits seems endless, ranging from J-3 Cubs to P-51 Mustangs, and there's also high-performance aerobatic aircraft. That reminds me—we have a kit to review here, and it just so happens to be a high-performance aerobatic type: the Extra 230-40. Let's get to it!

THE KIT: All the parts—from the hardware package to the fuselage itself—are sealed in plastic bags. Remember that these kits come approximately 90 percent complete, and if you look at the photo showing the parts as received, you'll see what I'm talking about. The hardware package contains: spinner, fuel tank, wheels, motor mount (that's already bolted to the fire wall), pushrods and quick links. The only things missing are the radio, the engine, the fuel tubing and the prop. There are no plans or blueprints, because you only have to glue the two wing-halves together, glue the stab to the fuse, and the vertical fin to the stab. All this is



Radio installation: Receiver is foam-packed and located forward of on/off switch.



Stab is supported by aluminum struts on bottom. Great security for high-energy aerobatics.

fully explained (with illustrations and photos) in a very complete instruction booklet. If you want to apply decals and trim pieces, they're supplied, too. Do add these Mylar and vinyl-type decals; it only takes a few minutes to apply them, and remember all the time you saved by *not* having to build the kit!

CONSTRUCTION: There are three major construction steps:

- Gluing the wing halves together (forward and aft wing joiner spars slip into channels on each wing half)
- Gluing the stab to the fuselage
- Gluing the vertical fin to the stab

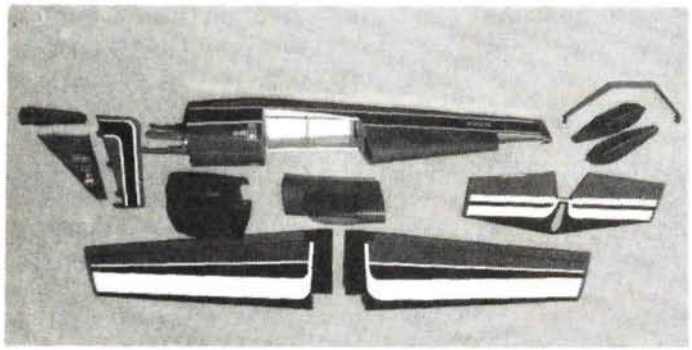
The time taken for these steps can range from seconds to about an hour, depending on the type of adhesive you use: If you use CA, you'll accomplish the task faster than if you use epoxy. (If you use CA, use a type that won't attack foam!)

The landing gear is the basic dural type, which is bolted to the bottom of the fuselage by way of pre-drilled holes in the landing gear and the fuselage landing-gear block.

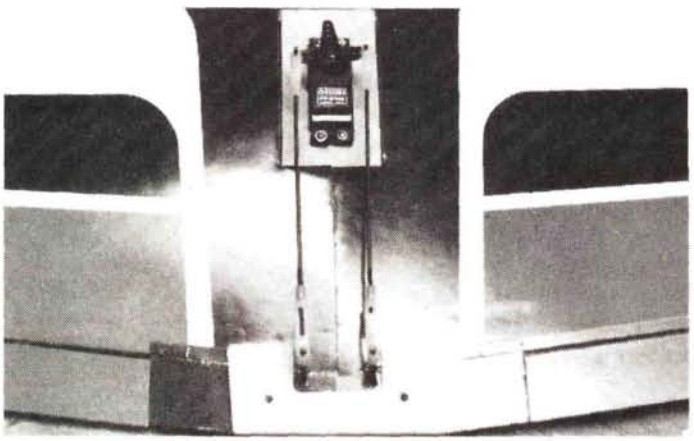
For covering, I just opened the box, pulled the parts out of their plastic bags, and I'd finished—sort of an *uncovering* job!

The radio installation is simple and straightforward. As I mentioned earlier, the pushrods are supplied with the kit, and I suggest that you install them before you glue the stab into place. The fuselage gets fairly narrow back there, but before the stab is installed, you can easily gain access to install the pushrods. I didn't do it this way, and I had a tough time trying to get the pushrods through the pre-cut openings in the aft part of the fuselage. The illustrated method works, but it isn't as easy as doing the job before the stabilizer has been installed.

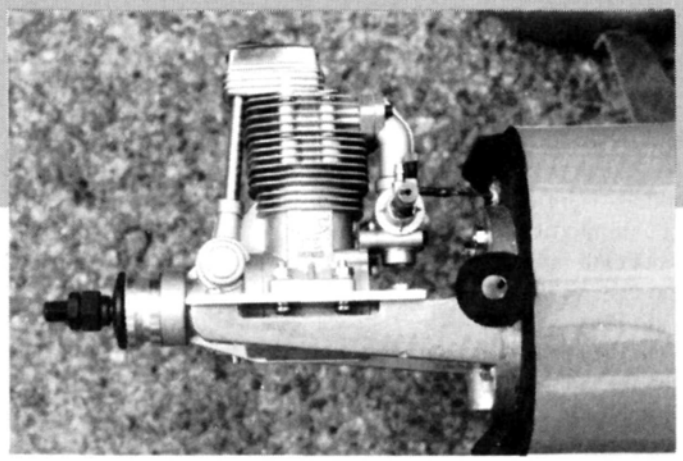
Also supplied are three die-cut wooden servo trays: one for the aileron servo that's used at the wing center section, and two for the radio compartment in the fuselage. The latter two differ in shape and size according to where each can be installed in the fuselage, and this allows you to mount a tray forward or aft, depending on which engine you use. If you decide on a 4-stroker, use the tray that positions the servos aft; if you use a 2-stroker, use the tray that positions the servo forward. This choice of position will help you to balance the plane, since 4-strokers are usually heavier than 2-strok-



Parts as received; all components are packed in plastic bags; no painting is necessary.



Aileron servo rides top of wing. Even servo tray parts are die-cut.



O.S. 70 Surpass 4-stroke proved to be quiet, but potent, powerplant for lightweight Extra.

Cowl encloses engine nicely with just rocker cover and muffler showing. Two-stroke engine would be completely enclosed.

ers. The choice is yours.

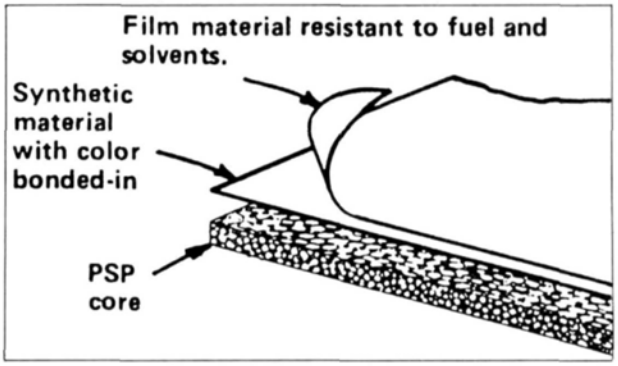
My radio is the new Futaba* 9VAP, 9-channel PCM 1024. Why use a 9-channel radio in an aircraft that only needs 4-channel operation? I just want to get used to the radio before I put it into my secret project (which, of course, I won't tell you about!), and since this aircraft looked like a potentially hot performer, what better test bed? The radio installation is fully explained in the instruction booklet and shouldn't pose any problems.

PERFORMANCE: Before going any further, check the plane's center of gravity! The Extra 230-40's ground-handling characteristics are like those of any tail-dragger; power must be applied slowly so that you don't get the full effect of engine torque. Remember to hold up-elevator and to feed in right rudder as needed. As the aircraft gains speed, relax up-elevator and the tail will lift. Control heading with the rudder, and a "blip" of up-elevator will then have you airborne.

I haven't detected any tendency to ground-loop during takeoffs or landings, and the only trim required was one click of "down." After that, I was ready to see what this plane could handle.

My engine is an O.S.* FS70 4-stroker, and it swings a Zinger* 11x7 prop. By the sixth flight, we were into the 11,000rpm range, and the engine proved more than adequate. I was, to say the least, very surprised (but also very happy) with its flight characteristics, because the Extra 230-40 handled every maneuver thrown its way. It's extremely aerobatic and will handle any flight procedure you care to execute (even the "ham-handed" ones). I like doing snap rolls from straight-and-level flight. The Extra 230-40 is so quick that if you blink, you'll miss it.

On landing, don't be concerned with a slow approach, because stall characteristics are good. If you fly off grass, I suggest that you increase the main landing gear's tire size to 2½ inches. On a newly cut field, the wheels supplied were OK, but if you go out on the day *before* grass cutting, you'll be pleased you changed to larger tires. Other than this, I saw no need to modify or change anything. Its easy assembly, its good looks and its great flight performance make the Extra 230-40 a real winner, and it ranks right at the top of my list!



Laminated construction is typical of skin material throughout EZ line. Note color is bonded in.

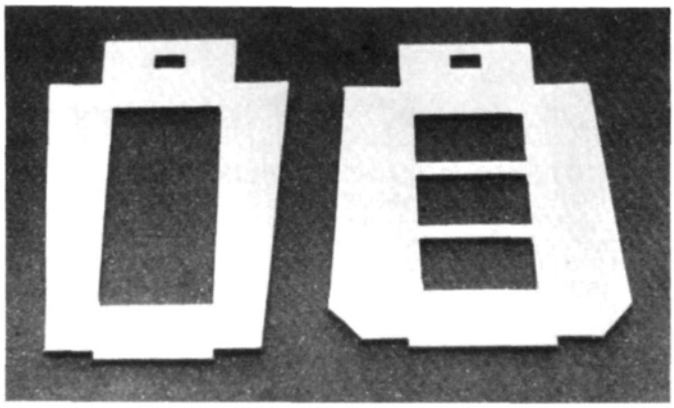
**Here are the addresses of the manufacturers mentioned in this article:*

***Global Hobbies,** 18480 Bandilier Circle, Fountain Valley, CA. 927208.*

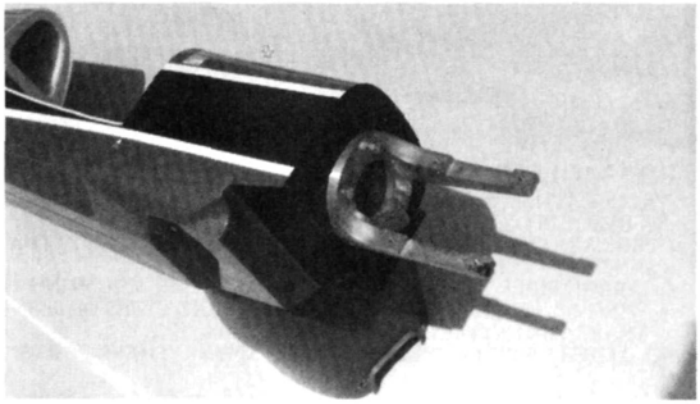
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.*

***O.S.;** distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*

***Zinger;** distributed by J & Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.* ■



Two servo trays are supplied to allow better CG control by positioning servos further forward or aft in the radio compartment. (See text.)



Pre-installed engine mount is uniquely designed to accept a broad range of engines.

GOLDEN AGE OF R/C

(Continued from page 30)

are electronically produced and controlled. Transistors and/or integrated circuits (ICs) create and vary the pulses *very precisely*—within fractions of a millisecond! The only mechanics involved are at the TX inception and the servo output, so the quality of the mechanics at these two points affects the system performance. At the transmitter, it's the control lever and its gimbal, plus the potentiometer wiper that it operates; at the servo, it's the motor response, gear train and pot wiper. These factors were weak in some early systems, but, luckily for us, continuing development has perfected them for *most* modern systems.

I've described *one* pulse, but I mentioned a "frame." With one pulse equal to one channel, a frame consists of *all* the pulses that a system requires, e.g., five channels, five pulses in one frame. Each TX-stick direction is associated with its own particular pulse, and operation in that direction won't affect the other pulses; in turn, that pulse will only affect the servo associated with it.

A major advantage of the digital concept is that there's practically *no limit* to the number of pulses in one frame. With each pulse electronically controlled (directly and separately), changed demands are met instantaneously, and with timing in milliseconds, the length of the frame is far shorter than anything we'd demand.

So the number of channels a digital system offers can be almost unlimited and is governed by the needs of our craft rather than by the limitations of the system. This is a great advantage over all other types of R/C systems. Actually, industry offers us the channels *they* think we want or need, and this explains why the 5-channel system is the most popular. Electronically adding channels to a particular system is easy—simply a matter of using a different IC or more transistors. The major additions are mechanical: more control sticks, connectors, etc. It's nice to know that we can have whatever we need so easily!

We seldom have difficulty with these digital systems today, and if we do, the problem is usually mechanical. This is the result of development; the concept introduced by Don and company hasn't really changed. So what has development improved?

First, early components were limited in performance and longevity, and they often had to be pushed to their upper limits, or we had to use more than one to meet our needs. The needs of the space program and gradual developments over time have led to dramatic increases in performance. We now have ICs that suit our space and weight requirements by neatly combining many transistors into a single component that's often smaller than one transistor!

Second, the cost of electronic components has plummeted. What was once a $9 transistor is now only one of several on an IC costing $1.50! This isn't just because we have Japanese R/C systems! The construction of early components had a "built-in" failure rate, and even with digital, we were still flying in the twilight zone!

Third, mechanics have been improved. Investment in mass-production tooling has led to the fabrication of parts that are much more precise than the earlier, blacksmith-style, parts found in early versions. Have you compared the *appearance* of a modern system with an early type? Today's even *looks* better!

With the advent of digital, almost all

(Continued on page 76)

GOLDEN AGE OF R/C

(Continued from page 74)

manufacturers seized the concept. Before the digital era, when choosing your R/C, you usually considered what made it "tick"; perhaps you liked the discriminator-style method of coding, or something about its operation seemed superior to you. With the arrival of digital, the question became, "Which *color* would you prefer—a gold, black, brown, green or white transmitter?" The "innards" are all so similar! Actually, we don't even have many color choices, as black predominates. Could this be a tribute to Dunham's "black boxes," by any chance?!

Out of time for old time—till *next* time! ■

SPORTY SCALE

(Continued from page 27)

modern-day wonders, these drawings were usually made by some poor slob who was just doing his job and made a mistake. If you're one of those unfortunate people who has a kit that was designed from bogus drawings, you'll be in a world of "hurt," especially if the three-view you've decided to use differs even more from the one used by the designer! But let's suppose that you've done your homework and that you've selected a kit or plans from a very reputable source—one who makes certain that his working drawings are accurate. Where does it say that he couldn't transpose a number or two? Where does it say that he didn't forget that last calculation just as his phone rang? Exactly! Once again, a victim of a mistake.

Let's go one step further and take a kit from someone as perfect as a Mr. Platt. Before you say that I'm favoring my old friend, don't forget that this man has won high static in all but three of the scale contests he has entered, I think. Anyway, this is an incredible statistic! Here we have this perfect outline that somehow survived all the die-designing and blueprint-shrink-

(Continued on page 100)

by RON FARKAS

CENTURY JET SPORT HAWK

ONE OF THE reasons why jet model flying is growing so rapidly is the availability of several, reliable ducted-fan propulsion systems that are easily adapted to a variety of models. Now model designers and kit manufacturers don't have to develop their own fan units, and Century Jet Models, Inc.* took this approach when it developed the Sport Hawk.

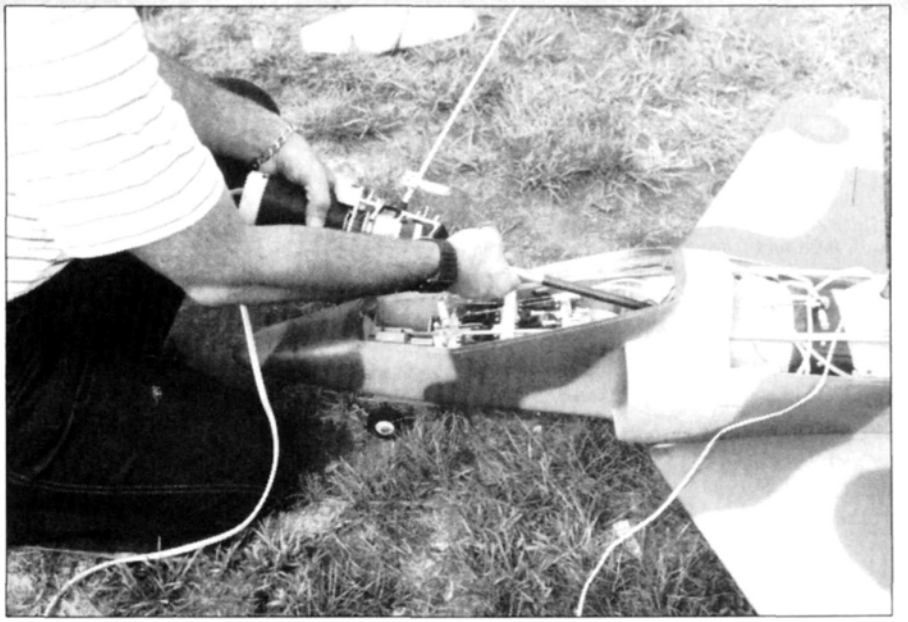
The inspiration for this model is the British Aerospace (BAe) Hawk ground-attack and weapons trainer aircraft, which is used by Britain's Royal Air Force and the air forces of many other countries. The latest variation on this airframe is the U.S. Navy T-45 Goshawk trainer, which was built under license by McDonnell Douglas. There was so much scale documentation in

Patterned after the globally popular British Aerospace Hawk, this glass-and-foam ducted-fan kit should do well.

PHOTOS BY RICH URAVITCH

SPECIFICATIONS

Type: *Ducted-fan sport scale*
Span: *59 inches*
Weight: *10 3/4 pounds*
Area: *580 square inches*
Wing Loading: *42.7 ounces /square foot*
Power Req'd: *.65 to .81*
No of Channels Req'd: *4 to 7*
Suggested Retail: *$189.99 ("short kit")*
Features: *Epoxy-fiberglass fuselage, inlet duct, exhaust duct and cooling cap, plus foam wing cores (three pieces) and foam fin. Builder provides all wooden parts.*
Comments: *Reasonable scale appearance in a jet that's well-suited to sport flying. Fast and maneuverable, with good handling characteristics. Prior ducted-fan experience would be an advantage.*



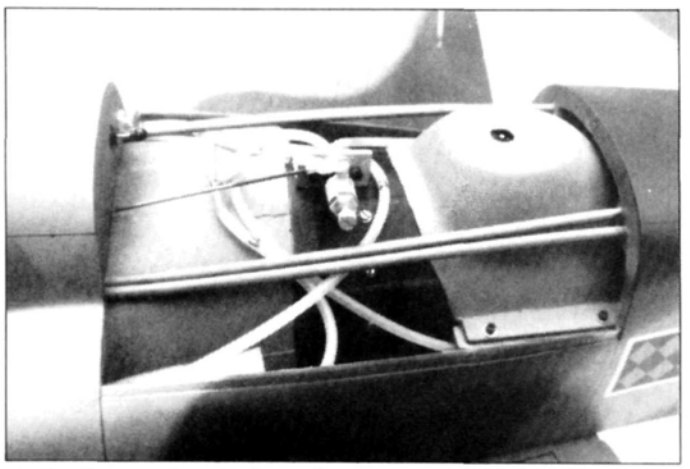
Starting procedure uses an extension shaft with a hex ball driver to engage the fan spinner. Better alignment than through engine inlet.

our editor's file that I had trouble choosing from the many colorful versions.

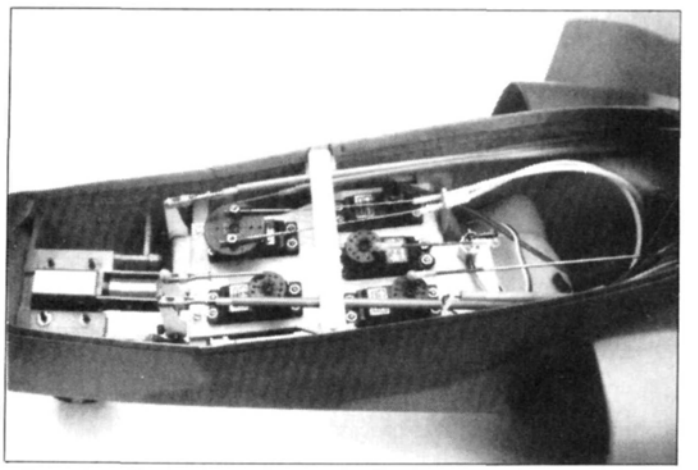
Although not true to scale, the Sport Hawk is close enough to look pretty realistic when finished in prototypical military colors and trim. Notable deviations from scale are its oversize intake ducts, absence of an all-flying stabilizer (stabilator) and the use of an opaque canopy. As its name suggests, the Sport Hawk is intended for enjoyable sport flying, rather than for scale contests.

A 4-channel radio is the minimum required for flight controls, with a fifth channel for retracts and a sixth for an optional speed brake. The recommended power is a .77 to .81 engine in a Jet Model Products* Dynamax fan unit with a tuned pipe. An alternative unit is the Byron Originals* Byro-Jet, but this requires some modifications to the fan for installation. The Sport Hawk doesn't use a cheater hole for additional air intake.

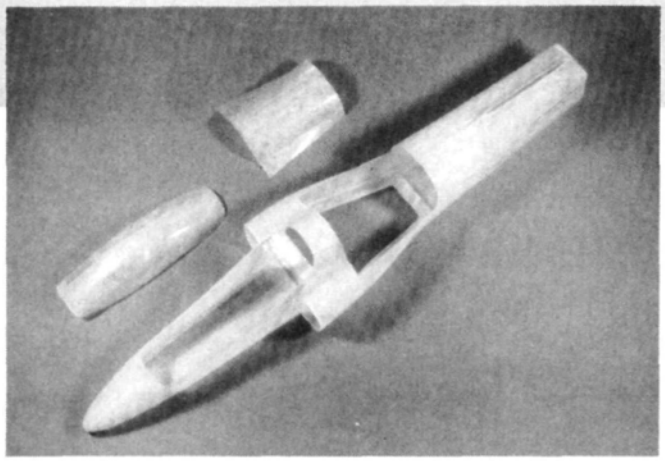
Century Jet Models markets the Hawk as a "short kit," and it includes an epoxy-fiberglass fuselage, fiberglass intake and exhaust ducts, foam cores for wings and rudder, and plans and instructions. The builder must supply all the wood and hardware, details of which are given on the materials list. The full-size plans have patterns for the bulkheads, internal structure and the tail section, and there are about 20 pages of



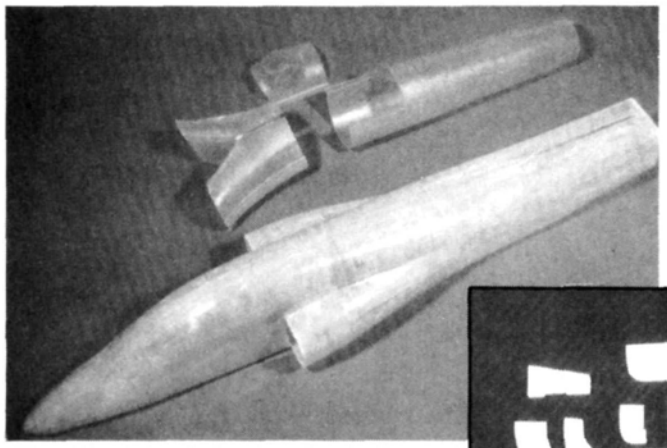
Pushrods pass through the engine compartment and can be spread apart for fan removal. In-flight mixture control valve is attached to top of the fan unit, and there's a 10-ounce tank on either side of the duct.



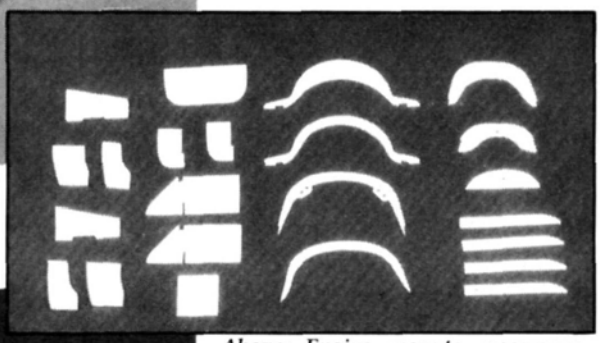
Servo installation is neatly contained on a removable tray under the canopy.



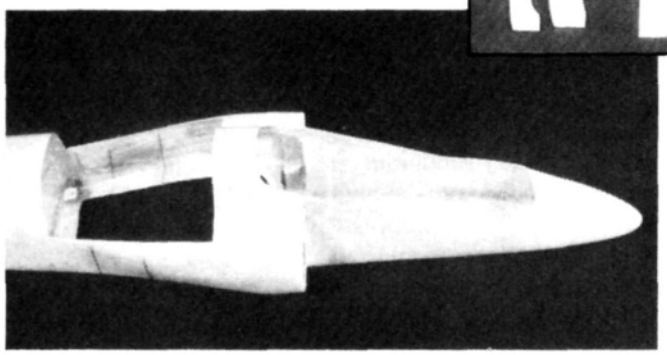
The builder must cut out the canopy and engine-access hatch; outlines have been molded in. A razor saw works well.



The kit includes the fuselage, intake duct, tail pipe and cooling cap. Components are made of epoxy fiberglass.



Above: Engine mounts, nose-gear mount and bulkheads must be cut from wood supplied by the builder. Patterns are on the plans. Author substituted Magnalite for light-ply.



Removable canopy and engine hatch provide plenty of access for both construction and field maintenance.

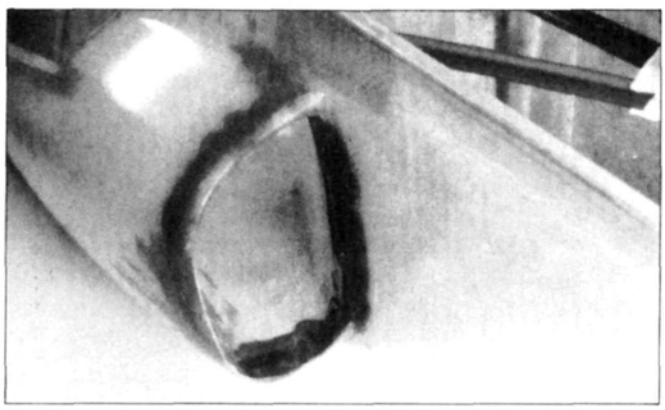
The Hawk is a good choice for an experienced modeler who wants to fly jets !

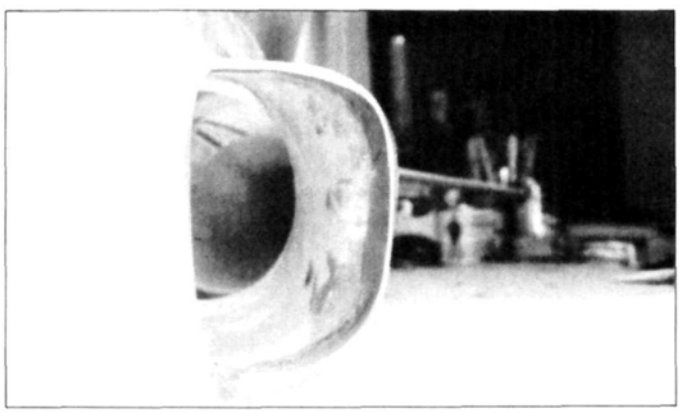
instructions and 28 photos. If you consider that ducted-fan models are some of the most expensive in the hobby, this kit's $189.99 price tag isn't outrageous.

The Hawk is a good choice for an experienced modeler who wants to start jet flying. It uses relatively common fiberglass-and-foam construction methods, but some of the construction steps are much more complicated than those of a conventional propeller-driven model, and some sections of the instructions are too brief. Prior experience with ducted fans is therefore a plus, and experience with these building materials is essential. Fortunately, while working on this review, I met Bruce Sanders and the Century Jet Models gang at a couple of trade shows, and they helped to clarify some of the trickiest steps.

CONSTRUCTION: First, cut out all the wooden parts so that they will be available when you need them. Several of the fuselage bulkheads are crescent-shaped, with their ends tapered to a delicate point. The plans suggest that you make these from 1/8-inch lite-ply that's faced on both sides with 1/64-inch aircraft ply, but I used Bob Violett Models* 1/8-inch Magnalite instead. It's stronger, lighter and easier to work with, so wherever lite-ply was called for, I substituted Magnalite.

I made See Temp* templates right over the plans and traced around them on the material to be cut. See Temp really works as advertised, and it's one modeling aid that no scratch-builder





Epoxy and microballoons are used to fill the area where the ducting meets the inlet lip. A 1/8-inch minimum radius is recommended (see text).

BAe HAWK...FLEXIBILITY IN ALUMINUM??

GIVEN ALL THE roles the BAe Hawk is capable of performing well—advanced trainer, attack trainer, aerobatic-demonstration team mount, and air-defense mission—one must wonder just how an airframe can be *that* flexible or adaptable. It probably comes from creating a base-line design with that multi-mission requirement in mind. However it was accomplished, it seems to be working, as the Hawk is now operational with many of the free world's air forces, and it has even been bought by the U.S. Navy as the T-45 Goshawk trainer. It will be produced, in part, by McDonnell Douglas as a replacement for the aging Rockwell T-2C Buckeye fleet.

What does the widespread use of this airplane mean to modelers? For the Sport Hawk builder, it means a broad choice of interesting and attractive color schemes, from the bright crimson of the Red Arrows demo team to the variety of user services camouflage finishes. That, in itself, should be enough reason to build this model.

should be without. A scroll saw and a belt sander were used for cutting and trimming the parts.

Wing: The wing should be built first. There are two outer wing cores and a center-section core. A vertical cut must be made in the center section for the full-depth spar; this separates the center section into front and rear pieces, which are then glued to the spar. The upper edge of the spar is contoured for a recess in the top of the center section, and this provides clearance for the fuselage ducting. I used the spar as a guide when removing the foam with a hot wire. Next, install the 1/4-inch-ply retract plates, the air lines and the pushrod tubes in the cores, as shown on the wing plan, then sheet the outer panels. I was very pleased with the Loctite* epoxy finishing resin that I used for bonding the balsa skins. At this point, the center section is only sheeted on the bottom.

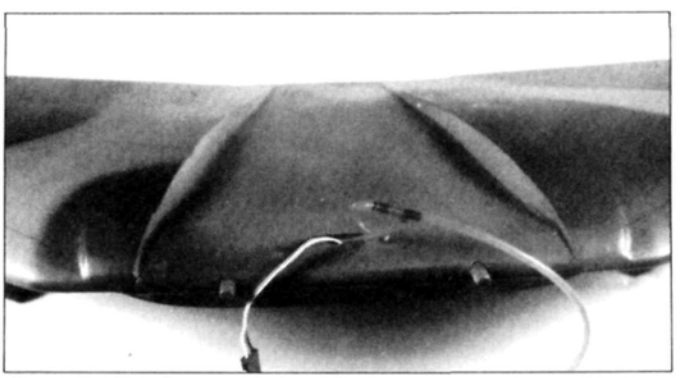
The wing panels are joined to the spar and center section with HobbyPoxy* Formula II slow-curing epoxy. This is done with the wing positioned upside-down on a flat surface, so that a flat top with slight dihedral on the underside is created. Next, the instructions tell you to cover the recessed portion of the center section with a 1/64-inch ply skin. I chose to postpone this step, since duct clearance can't be verified until the wing is mated to the fuselage. In fact, I later had to shave the spar and remove more of the foam to clear the duct, so I'm glad I waited.

The remaining wing work is pretty routine: adding leading-edge stock and wing-tip blocks; cutting out, capping and hinging the ailerons; hooking up the pushrods and installing the retracts. I installed a single servo with plastic pushrods, although separate servos could be used. (The plans show both versions.) The only significant modification of the wing would be the installation of the optional speed brake in the center section, but, for the sake of simplicity, I didn't use this feature.

Fuselage: I was pleased that the fuselage was straight and light, but there were several dry, porous areas, so I sealed

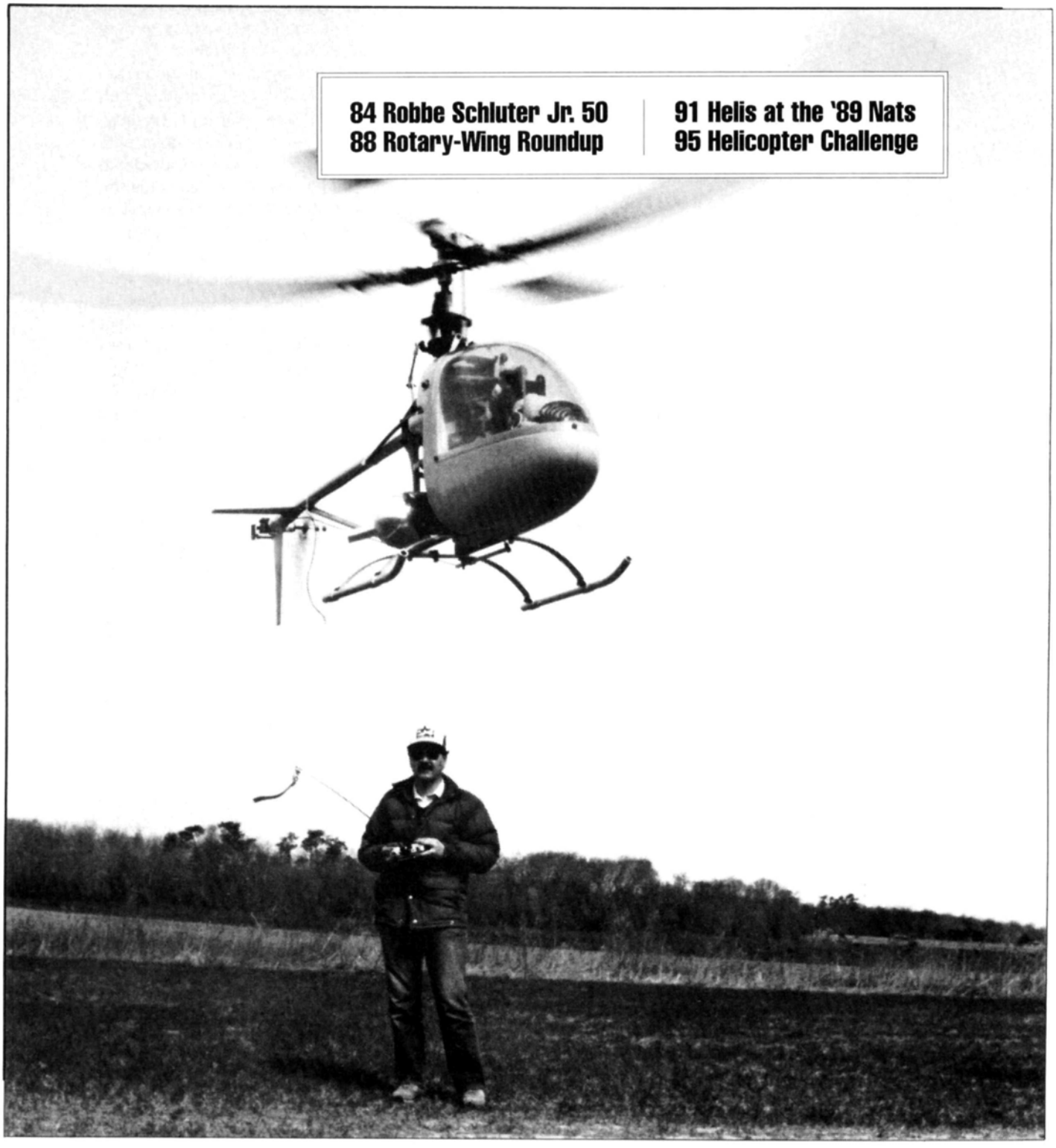
(Continued on page 107)

et Model Products' new Quiet Pipe exits flush with the end of the hrust tube and is attached to a plywood hanger by an O-ring.



Center section of wing is recessed for duct clearance. Retract line and servo lead both exit the wing beneath the radio compartment, right in front of the intake duct.

HELICOPTER SECTION



PAD & BENCH REVIEW

by DICK TRISTAO

THE FOCUS IN R/C helicopters seems to have been entirely on the top-end .60 machines or on the "halvers" (the .30-size offspring) but little has been done to update the mid-size machines and to keep pace with developing technology. Taking time out from top-end development, Dieter Schluter returned to a well-proven segment of his Robbe Model Sport* product line and directed

A full-size heli for all seasons from one of the pioneers

It's about time the mid-range models were brought up to today's specs. Though smaller than .60 machines, stability and smoothness will convince you it isn't to be treated differently. It may be a Junior, but it behaves like a grown-up!

his attention to the popular .40-size Mini-Boy as a target for updating, refining, or replacing. Refining an existing airframe usually necessitates a sturdy price increase, and since the Mini-Boy is Schluter/Robbe's entry-level model, it made sense to leave it alone and concentrate on a new ship. The decision turned out to be a wise one: The Mini-Boy remains virtually unchanged; it's a good model at an affordable, competitive price.

By borrowing pieces from the Mini-Boy and the Scout .60 and throwing in a few creative engineering ideas, a new .40- to .50-size airframe emerged. Dubbed

ROBBE/SCHLUTER JUNIOR 50

the Junior 50, the model fits current design trends: It combines high-tech plastics with proven metals; it employs anodized or electrostatic-coated finish; and its size is comparable to those of most models in the same engine range.

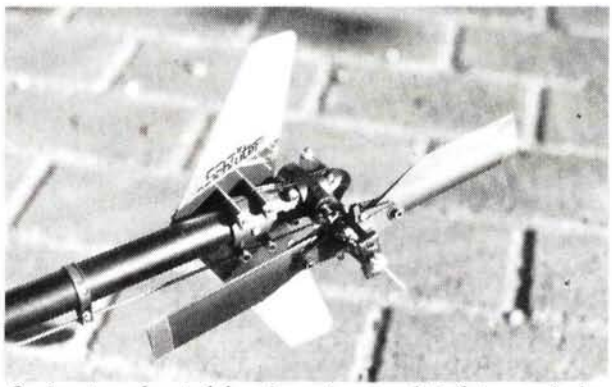
PHOTO BY DICK TRISTAO

THE KIT: The basic airframe, the engine mounts, the clutch and the drive components appear to be slightly different from those on the Mini-Boy, but the modifications are so slight that these parts are interchangeable and share most part numbers. One very positive carryover from the Mini-Boy is in the clutch-shaft alignment: Usually the sole source of destructive vibration, this problem is nonexistent, as the clutch rides on three pins that protrude from the engine's fan hub. Sleeved with Teflon bushings, the unit forms a sort of universal joint for smooth power transfer. Aside from these items, everything has either been specifically designed for the Junior 50 or borrowed from its big brother, the Scout .60.

ASSEMBLY: An angular, long-snouted canopy covers the revamped woodwork that forms the radio cabin. Servos mount exactly as they do in the Scout: Schluter's own plastic rocking-servo system provides slop-free collective and cyclic control. There's ample room in this elongated radio box to accommodate servos of any size or style, a battery pack and a tail-taming gyro. A molded fuel tank of ample capacity is keyed into the woodwork and trapped between it and the frame. Schluter didn't design an exotic canopy-attaching system for the Junior; instead, it's a simple "snap over the former and hold with a rubber band" trick.

To keep the Junior out of the mud, a couple of aluminum skids are attached to flexible nylon struts. A simple, but innovative, technique is employed in the landing-gear assembly: The strut ends are molded half-circles that rest on top of the skid. A plastic dowel is threaded onto an extra piece of pushrod and pushed into the skid to line up with a pre-drilled hole. A bolt drops through a molded hole in the strut and self-threads into the dowel.

The Schluter rotor-head design has evolved from simple fixed pitch to complex collective. The Junior's rotor system is the same as those on current Schluter designs: Made of plastic and steel, it has a single axle, and it's thrust and ball-bearing supported with an underslung flybar. Assembling the rotor head is a first with the Junior, as all previous Schluter kits have the head partially or completely assembled. It takes a little time, and there are numerous small pieces that disappear easily, so work carefully. The plastic parts are beautifully and precisely molded, but

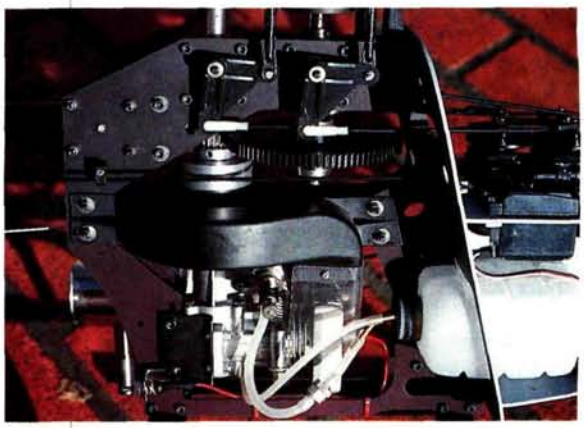


Owing to relocated bearings, improved tail transmission handles power loads better. Linkage and blades are standard Schluter.

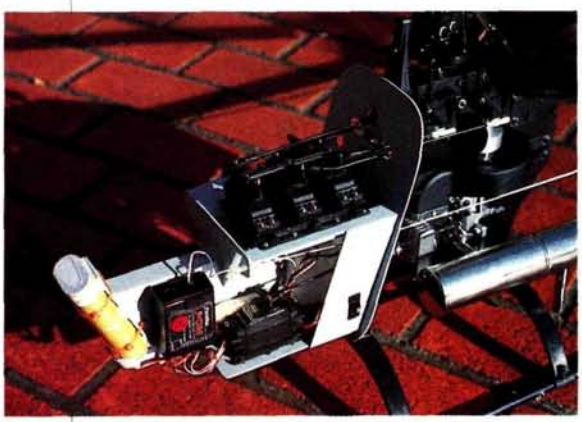
occasional shaving of corners was required to get bearings and locknuts to press into their respective slots. Once completed, the rotor head is bulky, but light, and presumably very strong.

While completing the rotor head and blades, two items gave me some cause for concern. First, the single-blade axle had considerable end-to-end play (about .5mm) at the blade grips. I called Robbe and

Robust, glass, fiber-filled parts constitute most of the Junior's main rotor and control system. The hundred or so parts needed to complete these assemblies are well-identified, both in their bags and on the building plan. In the control arms, Teflon bearings (rather than the steel ball-type) work beautifully and have no play. Control system is very slop-free.



Power compartment features molded cooling shroud and three-point, Teflon, bushed floating clutch. A slight misalignment of the engine will still allow smooth power transfer. Autorotation gear is standard feature. No, a .60 won't fit!



Spacious radio-mounting area is assembled from supplied wooden parts. To custom-fit servos, some pieces slide around before final gluing. Any combination of radio, battery and gyro will fit with room to spare. Steel pin bearings in the servo-rocking system are simple and friction-free.

was assured by Schluter guru Vince Canzanese that, if assembled according to the instructions with the included shims, the head will neither vibrate nor run out of track. In the first production run of kits, the axle was slightly too long, but this has been corrected, and current kits include an axle of the correct length. The assembled head should have no more play than the .5mm mentioned. My other concern was that the mounting hole in the rotor blades seemed very close to the leading edge. Since most blades have the attach/pivot at somewhere around 30- to 35-percent CG, I figured mine were flawed. "Nope," said Vince. "Put 'em on and go fly."

The swashplate and related linkage is another innovative feature. Until the Scout series, Schluter swashplates have been rigidly attached to the main shaft, except on the multi-blade systems, but now the rascal slides on the shaft like those on most choppers, but there's a slight variation: It's suspended from four points of the side-frame-mounted control bellcranks. It looks weird both at rest and in motion.

Suspended sliding swashplates have always been considered the most effective for transferring true cyclic motion to the blades, but the stresses "fed back" from the rotating blades can make the swashplate wobble or bob on the shaft owing to the loads imposed on the single-side servo pushrod connection point. Dieter rotated the swashplate 45 degrees counterclockwise and supported it from four points; each pair of points is a takeoff from opposite sides of a single servo, so the feedback loads are absorbed equally by each side of the servo arm, and play in the servo output is cancelled.

When operating the transmitter sticks, you'll find the swashplate responding in an unusual cross-controlled fashion. Since control input is now advanced 45 degrees, a forward push on the cyclic stick prompts the swashplate to dip in front and 45 degrees left of the fuse center line, rather than simply dipping down in front. Mechanically, the inputs make most of the corrections that were previously made by the pilot.

In a model that's controlled in the standard way, forward stick introduced front-down swashplate, and this translated into forward flight. As the model gained forward speed, however, a certain amount of left roll cyclic had to be input (aileron effect of advancing/retreating blade). The 45-degree advance timing reduces the need for these inputs. Some pilot adjustments are still necessary, but these are minimal. This is probably the closest you'll come to obtaining pure rotor directional response in relation to stick input.

Another hand-me-down is the re-designed tail-rotor assembly. This molded-plastic unit is smaller and better looking than previous designs. The output-shaft support bearings are moved out to the case sides, and this allows the bevel gears to be centered between them. This provides better shaft support in an area that's under heavy—and constantly changing—torque loads. The tranny-case halves now clamp around the outside of the tail boom rather than slipping inside as on previous models. The bolts that compress the halves also capture the vertical fin. Since this clamping is on the tube end of the tail, the stress of a fin striking the ground is less likely to snap the transmission case (that's a gentle strike, folks; not a slammer!). In-use, proven,

pitch-change linkage and molded rotor blades complete the rear end.

Control-rod adjustment is aided by an included jig that's placed between the swashplate and the chassis top. When the servos are centered and the swashplate rests on the jig, the ball-link ends are twisted until the rods are the appropriate length. Check the blade pitch at this point and set it at positive 2 degrees. Carb arm position and tail-rotor pitch are set according to the illustrations. How close was it? Nearly perfect! On the first liftoff, one out-of-track blade was corrected with a half-turn of a link. No cyclic trim was required, and the tail rotor only took three clicks left.

Finally, rotor motivation is provided by an Enya* .50X helicopter engine. This was my first experience with Enya helicopter engines but, because of its reputation for producing high-quality engines, I didn't anticipate any problems. Glow-plug access is limited, as the head points forward in the chassis, so I installed a remote head-lock from McDaniel R/C*. Guidance is provided by Futaba's* PCM 8 helicopter radio with S-130 servos. Although this radio has been discontinued, I still think it's currently the best buy. If you're looking for value rather than for newer, video-type displays, it's a steal, and it can be upgraded to 1991 specs for a small fee. A GMP* gyro provides tail dampening, and a 1200mAh battery powers it all.

PERFORMANCE: Depending on who's at the sticks, the Junior's flight characteristics range from docile to *ohmygawd!* If the control throws are set according to the instructions, you'll have a smooth, responsive machine that will suit most fliers. Those who want tender hovering and moderate circuit agility can use low rate. Pilots who aren't happy unless the machine will eat its own tail can set the throws to mechanical maximum, speed up the rotor a couple of hundred rpm, and produce lightning-fast, blurred aerobatics.

Under normal set-up, the Junior's rotor speed is high (around 1900 to 2000rpm), and it seems happiest there. Owing to the 1:7.5 engine-to-main-rotor ratio, this speed puts the engine turning between 14000 and 15000rpm early in the horsepower band. Higher rotor speed makes the helicopter gnat-like during maneuvers, but it puts the engine slightly over the horsepower peak. Aerobatic response is then quick, but "ham-handing" the sticks will produce engine "lugging."

The 1900- to- 2000rpm range seems the best all around; anything slower, however, causes the tail boom to shake visibly. At first, I thought the shake might be caused by the aforementioned axle play, or unbalanced blades or flybar, but a tear-down revealed that everything

(Continued on page 127)

ROTARY-WING ROUNDUP

KALT Omega Professor

Only serious helicopter pilots need apply for the Omega Professor from Kalt. Designed from scratch by the former World Champion Sheigeda Taya, there's no other kit like this in the world.

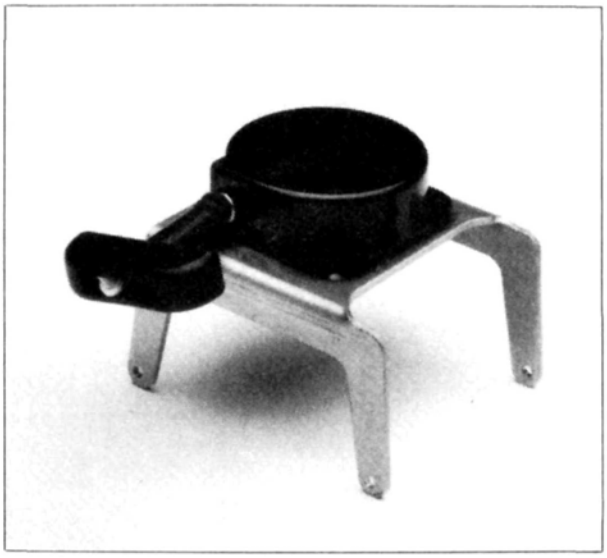
For competition, the Omega Jetstream fuselage can be finished at less than 10.5 pounds, making use of a sleek body shell that's practical even in the demanding FAI competition category. The profile of the Omega Jetstream fuselage catches the eye continuously, yet the Omega remains sturdy enough to handle the loads of long-term use.

The Omega is for serious helicopter fliers who want to reach the height of their potential. Kalt and Hobby Dynamics offer support for replacement parts and service, as well as expert advice, and you'll have the prestige of owning the world's best—the Omega Professor.

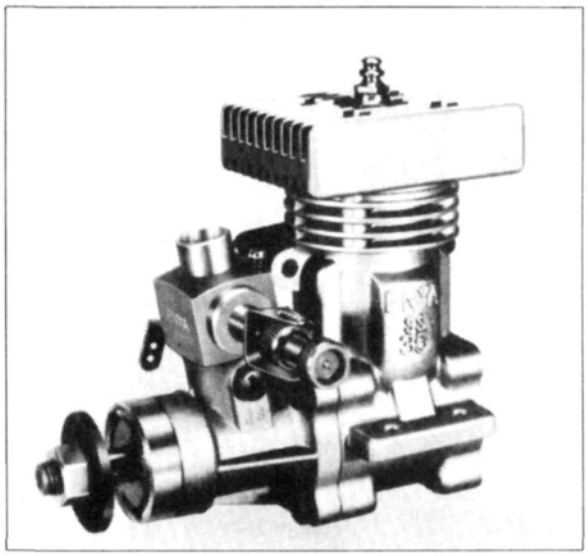
For more information, contact Hobby Dynamics, 4105 Fieldstone, Champaign, IL

KYOSHO Concept Recoil Starter

Kyosho introduces a new recoil starter for Concept 30 owners. This convenient starter is a quick and easy alternative to an electric starter and 12V battery. It will mount quickly in place of the starter cone and includes all necessary hardware. Concept 30 pilots can have the freedom of having less equipment and spend less time involved with electric starters. For more information, contact Great Planes, P.O. Box 4021, Champaign, IL 61820.

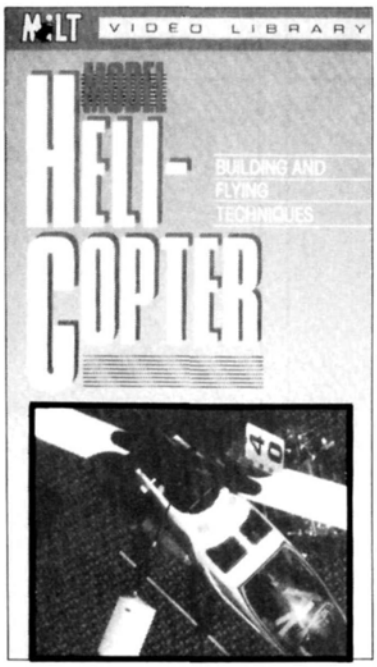


ENYA .35 Heli Engine

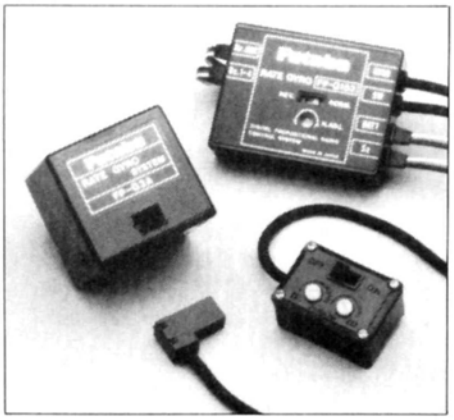


The Enya .35 heli engine has a host of outstanding features. It's a ringed engine with a .35-cubic-inch capacity, and it comes with a heat-sink head. Two ball bearings support the crankshaft, with a 1/4-28 threaded end for easy installation into helicopter transmissions. It develops up to .9hp with an rpm range of 2,500 to 16,000. Other features include the same mounts as the Enya SS30, the Enya TN 5.6mm carburetor and a two-needle carburetor for adjustability. For more information, contact Altech Marketing, P.O. Box 391, Edison, NJ 08818.

MILT VIDEO Model Helicopters



"Model Helicopters," the most complete instructional video available, is all you need to get started in this exiting hobby. Helicopter expert Datu Ramel guides you through every step of construction and pre-flight. Then, using a revolutionary, two-camera technique, he gives you a complete flight course in which you're able to simultaneously watch the airborne helicopter and the hands of the pilot. It's as close to actual flying as you can get without going to the field! Packed with vital information, this video belongs on the shelf of every enthusiast, from beginner to expert. For more information, contact Milt Video Library, 33 Lakefront Rd., Putnam Valley, NY 10579.



FUTABA Gyro Stabilizer

Futaba's gyro stabilizers provide the minute attitude corrections a ground pilot would give if he were actually in the cockpit sensing the plane's movements. The model G-135BB is a new, precision-ball-bearing, single-axis unit with a J-connector (G-133BB uses the standard 3-pin connector). Power is 4.8V that's shared with a receiver or a 6V external power supply. The amplifier draws 20mA at 4.6V, while the motor draws 100mA. The dimensions of the gyro body are 1.57x1.65x1.60 inches, and the control box measures .94x1.34x.59 inches. The total system weight is 2.15 ounces.

For more information, contact Futaba, 4 Studebaker, Irvine, CA 92718.

Plenty of action from a lot of new faces

HELIS AT THE '89 NATS

by CRAIG HATH

THE SPIRIT OF competition has a strong appeal for many, and because of that, the Academy of Model Aeronautics (AMA) has hosted a National Championship for model aircraft for more than 50 years. The Academy makes the rules that govern model flying, and it sets out guidelines for modelers to follow if they want to compete in organized competitions with the AMA's blessings. Every year, the Nats (as we like to call it) is held in a different part of the country, so giving fliers a chance to attend a Nats when it's in their part of the country without traveling a great deal.

The '89 Nats were held in the tri-cities area of southeast Washington state on July 15 through 23. The helicopter event was held from Sunday July 16 through Tuesday July 18, and I was honored to be chosen as contest director. Because of this, I have a somewhat unique perspective on the contest. As contest director, I had some very specific goals, and I think that, with the help of many others, all of them were met.

The selection of a site for the helicopter event has often been a problem, and this year was no exception. The field that we were originally supposed to fly from was very dry—all weeds and dirt—and our spinning rotor blades would surely have created a first-class dust storm. After a long discussion with other contest officials, and with the help of some of the competitors, by Saturday afternoon, we had secured a much better site at a local school yard. Two other sites had been originally selected, but during the time between when they were selected (early in the year) and Nats week, both had become unusable. If it weren't for the dirt, the site that had been set up for us really would have been ideal, as it was right along the banks of the Columbia River.

Flying started promptly at 8 o'clock on Sunday morning, but after two hours, it was raining quite steadily, so the pilots voted to halt the contest until 1 p.m. After that, there were no real delays, and the weather was good for flying most of the time.

I was determined to get in as many rounds of flying as possible. It seems to me that if contestants travel some distance to attend a national event, they should have ev-

PHOTOS BY CRAIG HATH

Vince Canzanese shows off his beautifully finished Bolkow BK-117, which earned him 3rd in scale. His caller is Mike Mas.

Silas Kwok's national championship scale Bell Jet Ranger hides Silas but gives us a good view of caller Peter Chow.

The only woman flier at the Nats, Laura Slocum (with caller Peter Chow) did a great job in Novice, but was edged out by Don Nelson.

ery chance to do their best flying, and that means scheduling as many rounds as possible in the allotted time. Since we only had 29 contestants, I had planned on six rounds of flying, but since the schedule was delayed by bad weather, we able to complete five, and that's more rounds than any other Nats, as far as I know.

Both as a contest director and as a competitor, I think the rules for the the FAI and AMA helicopter classes are extremely vague, and this makes it difficult to eliminate subjectivity from judging. Many of those who entered were flying in their first contests and had little idea of what to expect from judges, and they needed specific information about how each maneuver was to be flown. For instance, the AMA rules give no guidelines about how many points should be deducted from a competitor's score if he performs a part of the maneuver incorrectly. By the end of the first round, I noticed that most of the fliers had settled on a fairly uniform style of flying and were imitating one another. If the rules specified procedures clearly, everyone could practice before coming to the contest. I spoke to AMA President, Don Lowe, about this, and he agreed that there should be a judging guide like that for pattern, and he suggested the submission of a "rules-change proposal" asking for the guide to be drafted. I've thrown my hat into the ring to handle this project, so if you have any suggestions, please drop me a note.

For judges, I picked two famous pattern fliers, Don Weitz and Steve Rojecki, who, with Carlos Oheida of Yakima, WA, ably handled the job. This team was exceptionally knowledgeable about aerobatics and how the maneuvers should be performed and judged in competition. By the end of the event, the judges were advising fliers on how they could improve their scores and their flying. If you've ever tried to watch flying for three consecutive days, concentrating carefully on every detail, you'll understand what it's like to be a judge. Everyone should try it once.

Thanks to a program written by Mike Lauman, our scoring was completely computerized and operated on site by Jim and Candy Gans. Other unsung heros include John Mann and Ron Schnieder, who ran the flight line, and Don and Naomi Griffin, who handled many chores like check-in and transmitter impound. Jeff Laftoska helped warm up the judges and keep the lines running, and everything went smoothly, thanks to these fine people.

There were as many personalities as there are contestants, and this event had a great mix that provided a good balance. Generally, I find that competition brings out a unique side of people as they find ways to handle the pressure. During a stroll though the pit area, you'll hear opinions on just about every subject. Bring up the one subject that really matters to a contestant (his performance) and you'll almost always get the same answer: "It's OK, but I blew the stall turn on the last flight," or "The

Above: Timothy Garton poses with his 2nd-place Iroquois gun ship. Loads of detail and realistic sound really impressed the crowds. Right: Timothy's Iroquois in flight takes you back to the skies over Vietnam a few years ago. Caller is Robert Gorham.

Left: National and World Champion Curtis Youngblood hauls away the hardware with Event Director Craig Hath, while Don Griffin (with camera) looks on in the background.
Below: Craig gives Best Junior Award to 12-year-old Dwight Larks, who, for a youngster who's a relative newcomer to helis, gave an impressive performance in Novice Class.

wind kind of knocked my scores down," or "My engine could have run better," etc. Competitors are rarely ever satisfied with their performance and are always striving for perfection.

There are four classes of flying at the Nats: AMA Novice, AMA Intermediate, AMA Scale and FAI helicopter. Each class is designed to accommodate the skills of accomplished fliers at a particular level, and even the Novice Class maneuvers are challenging. The Scale Class is the place for a builder who strives to replicate a full-size model in miniature and then fly it! Even though we only had three Scale entries, that class attracted the most spectator attention—quite a show stopper.

Novice was won by Don Nelson of Darien, IL, who just edged past Laura Slocum of Sunnyvale, CA, in 2nd, and Mike Doughty of Helena, MT, in 3rd. These three had a real battle from the start, and they did a fine job. We had our only junior flier in Novice Class: 12-year-

(Continued on page 133)

Helicopter Challenge

by CRAIG HATH

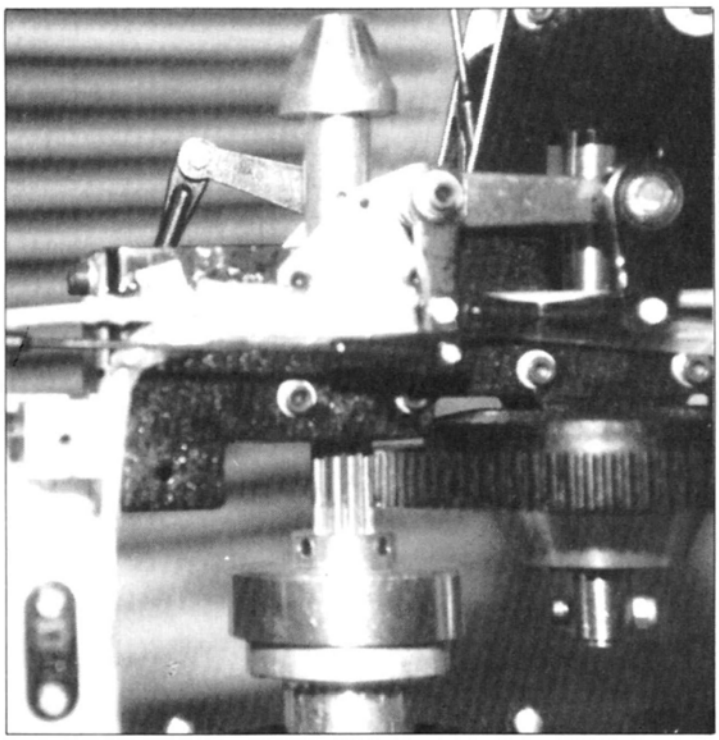
Buyer's Guide & Bent Shafts

LOOKING BACK OVER the three years during which I've been writing this column, it seems that my subjects have originated from all parts of the world of model helicopters. In the beginning, I talked strictly to novices who were just getting into the sport. As I moved on to more advanced flying, I always tried to focus on the needs of novices, and I've now come full circle: Once again, there's a large group of newcomers who are interested in even the most basic heli details.

This column will always be centered on tips and instructions to help those who are trying to get their helicopters airborne and who are desperate for good advice, but I've decided to adopt a new format that will encompass a little of every aspect of R/C model helicopters. This new format will allow me to continue to provide information for modelers at all levels of skill.

This sport has existed for only a relatively short time, yet it has come a long way. Early helicopters were very difficult to fly because they were only capable of short, mostly stationary, hovers a few inches off the ground and an occasional circuit through forward flight. Most attempts at returning to a hover would send chills through the hearts of the pilots and, more often than not, landings were just controlled crashes. The reasons for this less-than-dazzling performance? These early helicopters were too heavy, the main rotors had fixed pitch, and they were underpowered. As designers like Dieter Schluter and Dewey Broberg began to build machines with mechanisms that more closely imitated those of full-size helicopters, the flight performances of models began to increase dramatically.

Choosing your first machine: Look at the machines on the market: Almost every manufacturer claims to produce a helicopter that will suit the needs not only of beginners, but also of serious competitors. In many ways, it would be difficult to make a mistake when buying any one of the current models. When shopping for your first model helicopter kit, however, decide



PHOTOS BY CRAIG HATH

This is the clutch/start shaft assembly that's typical on most 50 and 60-size helicopters. It has the potential for some real problems.

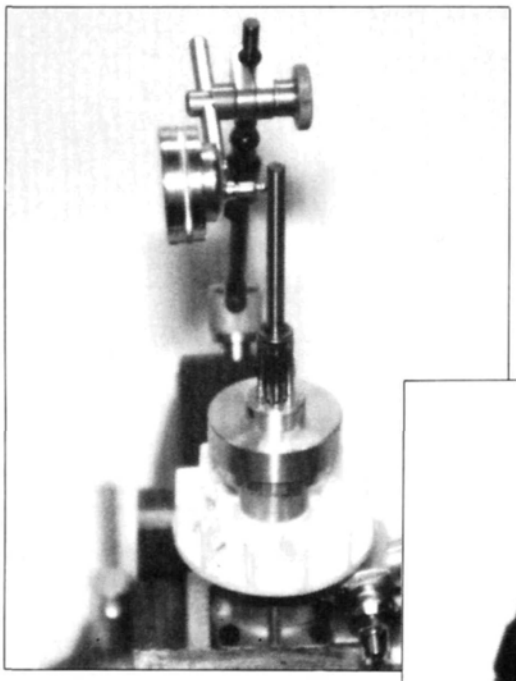
Start-shaft run-out being checked at the top of the shaft should be less than .002 inch

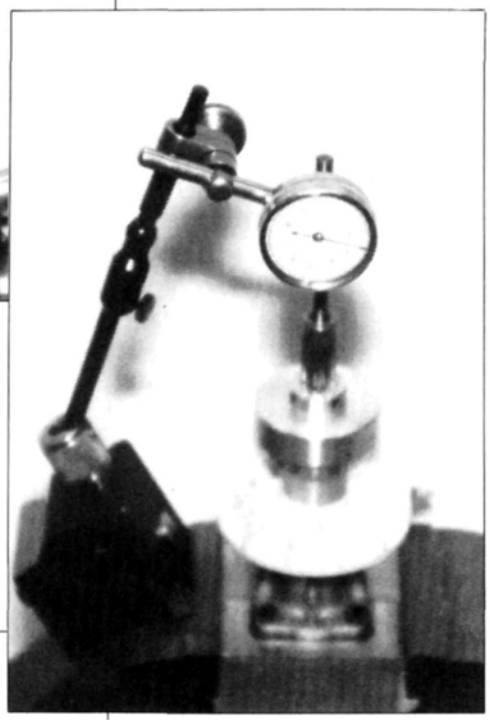
what's important to you before you buy. Plan to spend at least $800—more, if you can afford it. If you're on a tight budget (aren't most of us?), consider buying a used machine; there are some excellent bargains out there.

Buying a used helicopter presents its own problems. You must be sure that the model is in good shape, that it's one of the most recent, and that it has easily available spare parts. The same holds true for used radio systems. During the coming years, we'll be using narrow-band equipment, and during the last few years, these systems haven't been sold everywhere. If you look around, you'll find some pretty good deals, as I suspect that many new helicopter owners become frustrated with the hobby and shelve perfectly good equipment.

When you've determined how much money you have to spend, you should also consider what you expect to achieve at first. With what type of flying will you feel most comfortable? Perhaps you'd like to build a scale model of a full-size helicopter and you aren't really concerned about aerobatics, etc. Perhaps you want the challenge of constantly improving your performance. Keep the answers to these questions in mind when buying your first equipment.

As an example, let's take a pilot who wants to fly well enough to be able to build and fly a model of a Bell Long Ranger. Most helicopter kits come in what we call a "pod-and-boom configuration" where the bare mechanics are partly covered by a body or canopy that's attached to the front of the machine. Some available fuselage kits allow you to convert the machines into scale models. These kits usually have fiberglass or molded-plastic bodies that must be assembled, fitted to the mechanics and painted. A modeler who wants to build the Long Ranger could learn to fly with a pod-and-boom helicopter and then buy a scale fuselage later, when his increased skill makes it practical. It's wise to check before buying a particular pod-and-boom machine to see whether its manufacturer offers a fuselage kit or recommends a kit that will work well on that machine.





Above: This view shows how the dial indicator touches the face of the shaft and reads any deviation in run-out as the engine is turned.
Right: The dial indicator reads in increments of .001 inch and must be held perfectly still during the checking procedures (hence the magnetic base and fixtures).
Below: Dennis Crews show us that a little helicopter can be a lot of fun; Dennis learned to fly with this Baron 28 many years ago.

Scratch-built or pre-assembled: Should you *build* your first machine, or buy a pre-assembled one? The latter are referred to as "almost ready to fly" (ARF) and you have only to install an engine and a radio and accomplish a few other basic assembly steps. These machines are perfect for fliers who have little interest in assembling a model, and just want to fly. All the ARFs currently on the market are in the .25- to- .32-cubic-inch-displacement-engine category, or what I call "little" helicopters! There will soon be a couple of .50- to- .60-cubic-inch models.

Size: There are basically two model helicopter size categories: .25 to .32 and .50 to .60. There are also a limited number of .40s out there. I learned to fly with a .25-powered helicopter and had a great time doing so, but I recommend the machines in the larger class be-

cause they're somewhat smoother in hover and forward flight. The larger machines handle wind a little better and are easier to see, but smaller machines cost less and are a more convenient size.

Lift: This is the force that gets the helicopter off of the ground, and two systems govern it: fixed pitch and collective pitch.

With fixed pitch, the main rotor blades are set to a predetermined positive angle of attack (the airfoil of the rotor blade is positioned so that, as it's moved through the air at speed, it will generate lift). The lift is controlled by varying the speed of the main rotor disc: increasing the speed to lift the helicopter, and decreasing the speed to make it descend.

With collective pitch, the rotor blades mechanically change their angle of attack to produce lift, while the rotor disc turns at a fairly constant speed. Collective pitch matches the movement of the main rotor blades with the opening and closing of the throttle so that, as more pitch is added to the rotor disc, more power is required from the engine to overcome the increased drag and keep the rotor turning at the same speed.

Collective-pitch helicopters respond to lift controls faster than fixed-pitch helicopters do, so they're a little easier to control. With a fixed-pitch helicopter, the pilot must be slightly ahead of the machine, since there will be a momentary lag in response to the throttle control. For this reason, I recommend a collective-pitch helicopter for beginners. Even though the fixed-pitch machine is much easier to build and maintain, I've never been sufficiently satisfied with its flight characteristics to be convinced that these helicopters suit the needs of beginners.

Now you have a basic "buyer's guide" for a first-time helicopter shopper. Next month, I'll look at radio systems and engines to go with your new machine.

Getting Shafted

Now to the ritual shared by many helicopter enthusiasts: starter-shaft alignment. Most 50- to- 60-size machines have a shaft that extends from the clutch up through a bearing block to the top of the mainframe where a starting cone is attached to the end of the shaft. This shaft is a direct connecting link to the engine, and it's the point at which the electric starter is placed in order to start the engine.

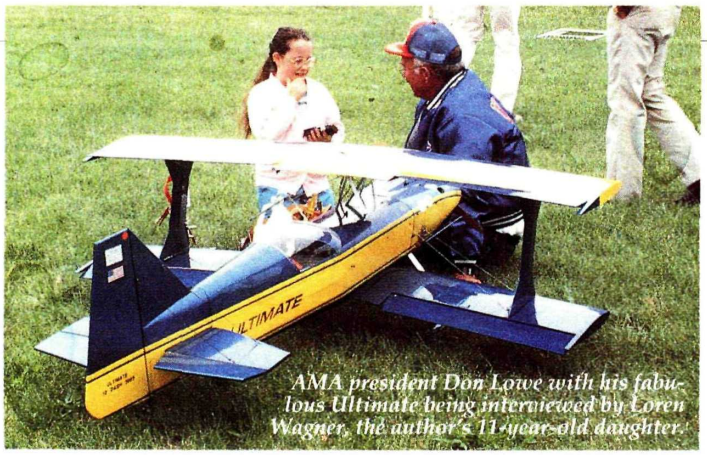
Since the shaft is connected to the engine, it will always spin when the engine is running. Our engines operate in the range of 3,000rpm (at idle) to about 14,000 to 15,000rpm on the top end. With speeds this high, the shaft must be set so that it turns as close to perfectly true as possible, or destructive vibration will be the result. To true the starter shaft correctly, you must have access to a very precise measuring device called a "dial indicator," which measures travel in very small incre-

(Continued on page 133)

AMA

FUN FLY

1989



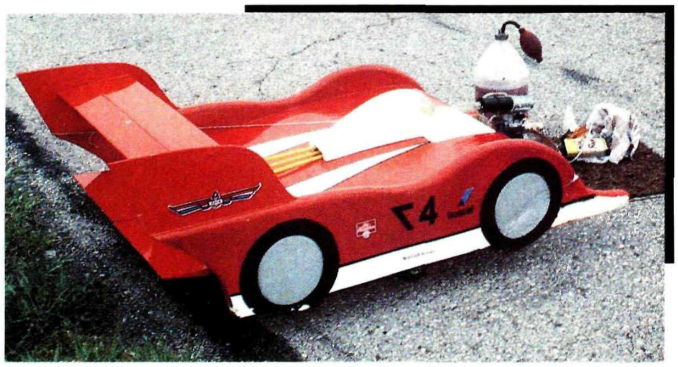
AMA president Don Lowe with his fabulous Ultimate being interviewed by Loren Wagner, the author's 11-year-old daughter.

Glenn Stucker's all-foam Jaws is the third of its type. Though fierce-looking, it flew as stably as a Piper Cub.

Fun flying on a really grand scale.

by JOE WAGNER

FROM AMA's* BEGINNINGS in 1936, more than 90 percent of its members have been sport fliers. Contest enthusiasts have dominated the club's policies for over half a century, however, so, until recently, AMA has put practically all its efforts into promoting model airplane competitions. Since I'm a dyed-in-the-wool sport flier (who joined the Academy in 1939), I'm happy to report that AMA's ways are now changing in our favor at last.



It looks like a car, but it's really a flying machine. AMA's Fun Fly drew many offbeat models!

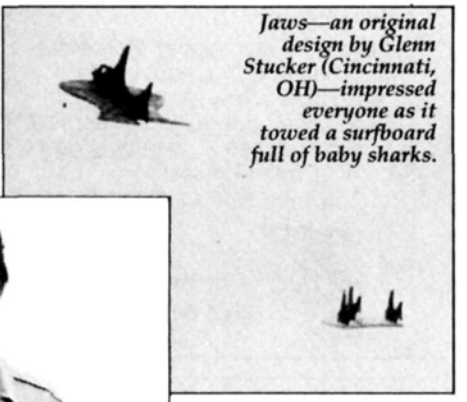
In the past year or so, the AMA has put on two National Fun Fly events: one in June '88 at Reno, NV; and another on June 10 and 11, '89, at Wright-Patterson Field, near Dayton, OH. I didn't go to Reno, but I went to the Fun Fly at Wright Field and thought it was terrific!

The turnout wasn't as great as had been expected. There were only about 100 entrants registered, but this might have had something to do with the weather: The spring of '89 was the wettest in the history of this part of the U.S. It rained in Dayton every day for two weeks before the AMA Fun Fly, and I'm sure that dampened the enthusiasm of many fliers who would otherwise have eagerly attended. Those of us who did make the trip figured, as I did, that it *couldn't* rain forever!—and it didn't. We had rain all

Another off-the-beaten-track airplane at the Fun Fly, this Partenavia P-68 twin flew well.

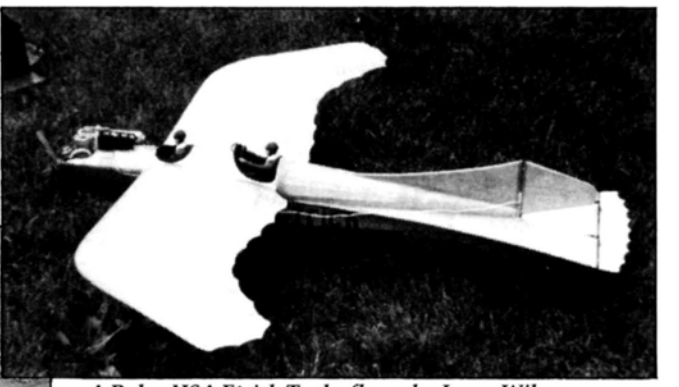
the way to Dayton (over 400 miles of downpour) and all the way home; but for the weekend, it quit!

Saturday was cold and windy, and many of those at the field were wrapped in blankets like Indian squaws. Few pilots flew, and most of us spent the afternoon in the Air Force Museum, but Sunday turned out to be ideal for model airplanes: sunny and almost calm. The fliers took good advantage of this break in the weather and more than made up for Saturday's inactivity.



Jaws—an original design by Glenn Stucker (Cincinnati, OH)—impressed everyone as it towed a surfboard full of baby sharks.

Don Naples (Columbus, OH) with his neat Nieuport 11C-1 scale R/C model. It's Cox .049 powered, with scale, cable-operated controls.



A Balsa USA Etrich Taube flown by Larry Wilson (N.Vernon, IN). Highly realistic, its performance matched its looks.

A 1/4-size RV-3, scratch-built by Ralph Braun (Winnetnac, IN). Ralph scaled the model directly from the full-size aircraft.

Despite the relatively small turnout, modelers had come from as far away as Nevada, Kentucky, New York, Louisiana and Iowa. AMA President Don Lowe drove up from Orlando, FL, with his magnificent Ultimate biplane, which he claims is the best R/C model in the world. (It looked mighty good to me, both on the ground and in the air.) *Flying Models'* columnist Larry Kruse came all the way from Liberal, KS. Unfortunately, he was only able to bring his cameras, so we were denied the pleasure of seeing Larry's beautiful craftsmanship in action this time.

Dave Brown was there, of course, and he flew his lovely Pitts-like precision aerobatic biplane. Quite a few novelty-type R/C models were also in the air on Sunday: lawn mowers; flying "race cars" and "flatirons"; and a huge-profile "shark" (which towed a "surfboard" occupied by three "baby sharks").

Possibly the most impressive flying was done by a young fellow from Dayton named Frank Noll: incredible low-altitude maneuvers with a 1,000-square-inch, all-built-up, .60-powered airplane that looked much like an old-time free-flighter. (It's called the Sundancer, and it's available in kit form from Air Flair*.) Frank hovered the thing motionless, flew pylon-8s around soccer goals, and rolled the Sundancer's wheels at the bottom of consecutive *octagonal* loops. At one time, he taxied his model for about 100 yards on one main wheel—and nearly all these maneuvers were done without much exceeding an altitude of 25 feet. Frank's performance was a real crowd-pleaser!

One of the best things about the Wright Field Fun Fly was the wide variety of models; the field teemed with aircraft types that seldom appear at contests. I saw an R/C autogyro with coaxial rotors, a tiny Tee Dee .020-powered sport aerobatic model, two Evans-type canards (one large, one small), several sport-scale airplanes, and even a 1/2A-powered amphibian. In modeling, when nobody's judging the flying and no prizes are at stake, creativity shows up far more strongly than at competitive events where most entries tend to look much alike.

At this meet, I spoke with AMA's Geoff Styles and John Worth about the Academy's plans for future fun-fly events. Despite the somewhat disappointing turnout, John told me that the AMA will probably host more fun flys in the future. Whether they do this or not will depend largely on what members seem to want. If *you're* an AMA member and would like to see the Academy put on many more non-competitive events like the Wright Field Fun Fly, write to AMA headquarters and say so! It's your club, and the leaders will only find out what you want if *you* tell them.

**Here are the addresses that are pertinent to this article:*
***AMA,** 1810 Samuel Morse Dr., Reston, VA 22090.*
***Air Flair,** P.O. Box 2075, Fairborn, OH 45324. Tel: (513) 878-7487.*

■

SPORTY SCALE

(Continued from page 76)

ing. Here we have the elusive, perfect kit. What do we do now? Do we save it? Do we wait to build it until our skills have surpassed those requiring a knife and fork? Of course not! We build the thing!

Then it's time for all your friends to critique your finished masterpiece, and some inconsiderate know-it-all informs you that the shape of your "perfect" tail is all wrong! Well, before you sign his death warrant, consider that he might be right! You see, one of the factors that determines whether or not your airplane matches the drawing can be found in any good modeler's workshop. It's called a sanding block. That's right! No matter how perfectly Mr. Platt or Mr. Lewis drew the plans and made the parts, it can all go to Bismark in a hand basket if you're a little too aggressive with the old sanding block! So this month's tip is to check those drawings, check the parts, and then sand *cautiously* for a perfect shape.

Well, that's it for this month. I'm off to the U.S. Scale Masters in a couple of days, so the next few issues should be loaded with new stuff. Also, since I last wrote, Top Gun has found an alternative home for the 1990 Invitational. The prestigious Arizona Model Aviators of Mesa, AZ, will be the host club, and the dates have been set for April 26 through 29, 1990. The headquarters hotel will be the fabulous (and I do mean fabulous!) Arizona Golf Resort* in Mesa. If you want to come, give them a call and mention Top Gun for special rates. If you want to be where the action is, don't be a bozo and wait too long. So far, we have 50 pilots and 10 team scale entries. *Model Airplane News* has teamed up with Pacer Technology as primary sponsors, and there will be lots of help from the rest of the industry. So far, there's more than $20,000 in cash and prizes up for grabs. If you want to see the best scale models in the U.S., don't miss this one! Call CD Jim Deming* for more details. If you really believe you deserve an invitation to the Team Scale portion of the contest, just call me* or write, indicating the two people involved in the team and giving some details about the aircraft you want to enter.

Last, but certainly not least, I just wouldn't feel right if I signed off before passing on the five most important things to remember while pursuing this art of scale modeling:

• Regardless of what Norm's advertisement says, there simply isn't a 375-degree retract servo.

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SPORTY SCALE

(Continued from page 100)

- Putting a 1/2-inch chunk of foam on top of the piston of your new 6-cuber will definitely *not* dampen its vibration.
- A chisel is *not* the proper tool for installing flat hinges.
- A Ni-Cd battery doesn't lose its memory simply because you've installed it in a different airplane.
- Always, always, *always*—especially if you see Mr. Four-Stroke, Chris Abate, approaching—check your six!

**Here are the addresses and telephone numbers pertinent to this article:*
Bob Holman Plans, *P.O. Box 741, San Bernadino, CA 92402.*
Mallory Models, *1104 Gatewood Dr., Alexandria, VA 22307.*
Don Smith, *2260 N. Dixie Hwy., Boca Raton, FL 33431.*
Arizona Golf Resort, *Tel: 1-800-528-8282.*
Jim Deming, *Tel: (602) 898-7020.*
Frank Tiano, *2460 S.W. 85th Ter., Davie, FL 33324. Tel: (305) 473-2211.* ■

QUIET FLIGHT

(Continued from page 43)

Scale Fun Fly

It looks as though the Tri-Cities Soarers might have started something with the Scale Fun Fly. The Torrey Pines Gulls of San Diego, CA, are planning their own Fun Fly event for the Thanksgiving weekend of November 24, 25 and 26. All scale sailplanes and power scale slopers are welcome to participate.

Charlie Morey*, editor of *Slope Soaring News,* is the PR agent for the Gulls event, and if you want more information, he can be reached at the address listed at the end of this article.

Electric Fun Fly

On October 28 and 29, the Cape Cod R/C Club, in conjunction with the Discover Flying R/C Club, will host the 5th Annual S.E. Mass Electric Fun Fly. This year will be a two-day event at the Sandwich High School Athletic Field on Cape Cod. AMA Rule-Book events No. 610 and No. 611 will be held, and there will be other judged events. There will be surprise awards and a prize for best model. If you're in the area, you might want to attend. For more information, call (508) 383-8453.

Well, that catches me up (almost) on recent correspondence. Remember, if your club is sponsoring an event and you want it mentioned in the column, give me at least three months' lead time.

Till next time, good thermals and a full charge.

**Here are the addresses that are pertinent to this article:*

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QUIET FLIGHT

(Continued from page 102)

Mr. Sticker, *18081 Redondo Circle, Suite E, Huntington Beach, CA 92648.*
Aero Graphics, *511 Franklin Blvd., Gastonia, NC 28052.*
Vinylwrite, *16043 Tulsa St., Granada Hills, CA 91344.*
Banzai Enterprises, *2997 Anderson Ave., Port Alberni, B.C., Canada V9Y 2V3.*
WL&J Enterprises, Inc., *17841 67th Ave., Tinley Park, IL 60477.*
Hi Line Ltd., *P.O. Box 1283, Bethesda, MD 20817.*
Astroflight, Inc., *13311 Beach Ave., Marina Del Ray, CA 90292.*
Jomar, Inc., *2028 Knightsbridge Dr., Cincinnati, OH 45244.*
Airtronics, Inc., *11 Autry, Irvine, CA 92718.*
Jet Hangar Hobbies, *12130 G. Carson St., Hawaiian Gardens, CA 90716.*
Charlie Morey, *Slope Soaring News, 2601 E. 19th St. #29, Signal Hill, CA 90804. Tel: (213) 494-3712.* ■

FLOATING AROUND

(Continued from page 56)

George has been flying his Stik for more than two years, and he must have almost 300 flights on it with no ill effects. Dick's Stik is more recently completed, very well-built, and should fly just as long if he doesn't hit a tree, as he did with his 1/4-scale clipped-wing Cub. During the photo session, I tried to persuade George and Dick to fly in formation, but we all soon found that this takes *a lot* of practice. No matter; it's a blast watching these two tear up the clouds. If you're ready for a utility-type sport plane on floats—one that won't bite you!—give the Stik a try.

Video Corner

Twenty-five years ago, Marshall McLuhan predicted the coming of the "information age." It seems to have arrived in most places; but, always one to resist change, I still write longhand and look on computers and "fax" machines with bewilderment. I must admit, however, that I enjoy seeing videotapes and find myself consistently amazed at how effectively they're used to exchange information. Even in my little corner of the world, I get at least three videotapes a month on float flying!

One of the best tapes I've seen lately is called "The Wonderful World Of Floats," and it's distributed by EAA* in Oshkosh, WI. The video was shot at Brown's Seaplane Center in Florida, and it's dedicated to the memory of Jack Brown, who probably trained as many seaplane pilots as anyone in the world.

Brown's has a fleet of perfectly restored J3 Cubs on EDO floats. They're used for training, and, on film, the contrast between these bright yellow Cubs, the deep blue lakes and the lush green forests is very striking. The video takes you through the 1 1/2-day seaplane-pilots' training course, and it's difficult to believe that anything has been omitted. Everything is there!—right down to the bungee-cord release for the water rudders.

I've often discussed the fact that the floats on full-scale floatplanes are drooped to provide a high angle of attack on takeoff, given their low power-to-weight rating, while modelers can mount their floats parallel to the stab or datum line, because we have the power. After seeing a 1/4-scale Cub take off in 40 feet and then watching the full-scale plane do it in 1,500 feet, you'll see what I mean. Another reason for drooping the floats in full scale and starting the takeoff run with full elevator comes to light in the video. Those guys *have* to keep the nose high, or they'll tear up a $700 prop in a minute! Enjoy the video, but remember the differences between full-scale and model float flying.

Another tape is Bud Schweisinger's* video of the 1989 Plat I Float Fly in Oregon. The Plat Float Fly is hosted by a group of *avid* float fliers: the Portland Sky Knights. Many of their models are cutting-edge stuff, and their emphasis is usually on performance, whether it's pedal-to-the-metal, ultra-maneuverable, or floater. The tape is a high-quality home production with a very friendly tone. There's an opening sequence of shots without narration, and this is followed by an exposition of the timed 4-minute contest event, narrated by the CD.

Most of the planes are shown performing. Steve Milos's new .90-powered, 8-pound Sea Hawk is there, as are a huge 11-foot Beaver, some Astro Hogs, biplanes, pit shots—the works! This video could be great for any club members who are thinking about running a float fly, and it's a really pleasant 1:55 minutes for anyone who enjoys float flying. Bud didn't tell me its price, but I'm sure it's very reasonable. For more information, contact him at the address provided.

That's it for this month. Keep your bottoms wet, your noses to the wind, your oars in their locks, an extra paddle up the creek, and your eyes on the sky. Have a great Christmas!

**Here are the addresses that are pertinent to this article:*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*
World-Tex; *distributed by World Engines, 8960 Rossash Ave., Cincinnati, OH 45236.*
John Sullivan Model Floatplane Products, *1421 Second St., Calistoga, CA 94515.*
K&B Manufacturing, *12152 Woodruff Ave., Downey, CA 90241.*
Sig Manufacturing, *401 S. Front St., Montezuma, IA 50171.*

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FLOATING AROUND

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O.S. Engines; *distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*
Bob Martin, *1520-C Acoma Lane, Lake Havasu City, AZ 86403.*
EAA Aviation Center, *Whitman Field, Oshkosh, WI 54903-3065.*
(Bud) Harold Schweisinger, *Rt. No. 1, Box 4430, Sutherlin, OR 97479.* ■

ABOUT THOSE ENGINES

(Continued from page 69)

wasted most of the engine's output, and he thus tamed his model's performance nicely. Had he employed a prop of the same size (a 6-3 Graupner) as the one I'd used on my .020-powered glider, his minuscule model would probably have been uncontrollable.

This, of course, was a special case. We usually want as much power as we can get from our R/C engines, but most of us go about this in the wrong way: by striving to "up" the rpm. A motor *sounds* a lot more powerful at high speeds, but it might not be doing nearly as much useful work for us as it might at lower, less impressive sound levels, turning an efficient high-thrust prop.

For most sport-type R/C model flying, a prop with a pitch of about half its diameter, turning at approximately 10,000rpm, is close to the optimum. Such a prop allows excellent engine idling, provides powerful thrust for takeoffs, climb-outs and go-arounds, and extracts a maximum of useful power from its engine. Such a setup runs quietly, too!

Some fliers I've discussed this with tell me, "Yes, but my airplane *has* to use a small prop. A big one would hit the ground on takeoff!" It's true that most R/C kit designs have rather low ground clearance, but by using larger-diameter wheels, you can gain room for swinging bigger props, and large wheels give much better ground handling on grass fields.

Here's the address and phone number of* ***Nelson Competition Engines:*
RD 2, Box 233, Ramsey Rd., Zelienople, PA 16063. Tel: (412) 538-5282. ■

SPORT HAWK

(Continued from page 81)

the most obvious ones on the inside with 3/4-ounce glass-cloth and HobbyPoxy Formula II glue, and I left the exterior for the finishing process. The main engine hatch and canopy must be removed from the fuselage by cutting around raised out-

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SPORT HAWK

(Continued from page 107)

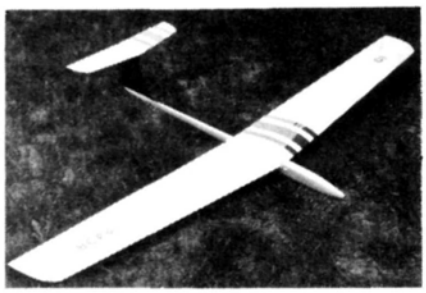
lines with a fine razor saw. Just before making these cuts, I trial-fitted the bulkheads for accuracy while the fuselage was still rigid. A couple of bulkheads needed minor trimming with a sanding stick, mostly to accommodate the internal seaming tape.

I set the fuselage aside so that I could start assembling the fin and stabilizer. The fin is a foam core that requires balsa sheeting, and the stab is a lamination of 1/64-inch plywood that's faced on both sides with 1/8-inch balsa. The stab halves are glued together with the dihedral. From here on, the fuselage is assembled from the tail forward. The stabilizer slots are cut out where they're marked on the fuse, and the stab is glued in permanently. Then the fin is installed, with its plywood stub-spar keyed into the stab.

Unlike many jets, the Sport Hawk has all of its radio system in the nose, so the plastic-tube pushrods for the rudder and each elevator half run the length of the fuselage and must be installed now. I've seen some designs that have the servos permanently mounted in the tail, and this makes it impossible to inspect or service them. For this reason, I prefer to have the radio accessible, as it is here; it's also better for balancing the model. The disadvantage is the undesirable flexing potential of long, plastic pushrod runs. For

(Continued on page 118)

Product News



CULPEPPER MODELS IO

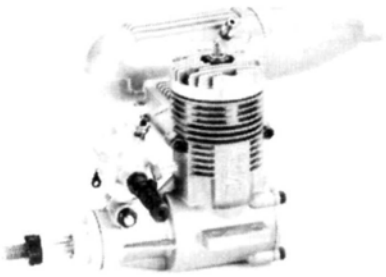
Derived from the Callisto, this very maneuverable 2-meter R/C sailplane can provide the performance needed to win in AMA thermal duration events. This has been proven by Terry Edmonds, its well-known designer, and other fliers. It's also at home on the slopes, as it's very clean and can be ballasted without removing the wing. It uses the same Eppler 193 airfoil as the Callisto. This favorite with scratch-builders is now available in various kit forms from basic foam wings and fiberglass fuselage to a nearly completed structure. With a wingspan of 78.75 inches, it has a wing area of 677 square inches, a fuselage length of 46.18 inches, and it weighs 38 ounces or more.

For more information, contact Culpepper Models, Inc., 2526 Washington, Dubuque, IA 52001.

A.R.B. The Buddy System

The Buddy System is an exciting new product that's expected to revolutionize R/C training procedures. The Buddy System is the only low-cost R/C trainer system designed to be installed in Futaba and Airtronics radios, using the same channel. The Buddy System can also be retrofitted and used with any other radio system. Installation can be completed in about 30 minutes by anyone who can solder two wires together. It's easy to use, so it makes learning and teaching R/C flying fun. Students gain structured "hands-on" experience in an anxiety-free environment. It's easy to install, and features a fully illustrated installation manual and user's guide. The Buddy System is affordable; in fact, it costs considerably less than the cost of repairs from just one crash. Students can be taught proper safety and control, so it's great for club instructors and store owners. Experienced fliers can use it to teach and to practice advanced maneuvers. The Buddy System is field-tested and proven!

For more information, contact A.R.B. Company, 8825 Roswell Rd., Suite 613, Dunwoody, GA 30350.

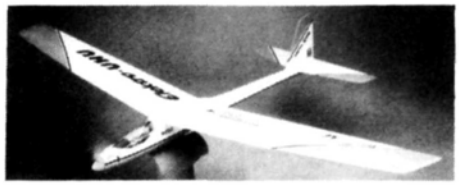


ASP .46 Aircraft Engine

The ASP .46 FSR ABC aircraft engine is the new bigger brother to the ASP .40. This engine isn't just a bored-out version of the .40; it incorporates a new lightweight, two-piece crankcase design. All improvements that are used in the .40 size, e.g., the new carburetor and sealed front bearings, are also used here. The ASP .46 features: a one-piece, hardened-steel crankshaft; mirror-smooth, true chrome plating on the cylinder sleeve; Schnuerle porting; ABC piston/cylinder assembly; ball bearings; and a new two-piece crankcase. With a muffler, it weighs 11.9 ounces; its idle rpm is 2100; its top rpm is 12,220. Suggested props are 10x6, 10x8 and 11x6. Carburetor, high-speed needle and idle cam screw are included, and it fits most .40-size mounts.

Part no. 22608. Price: $114.96.

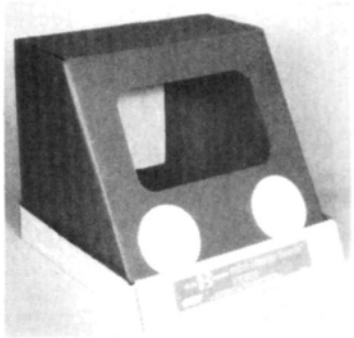
For more information, contact World Engines Inc., 8960 Rossash Rd., Cincinnati, OH 45236.



HOBBY LOBBY Electric-Powered Sailplane

New from Hobby Lobby is the Elektro-Uhu. Its motor, battery and prop are designed as a unit! With a 66-inch span, Elektro-Uhu is a sleek, fast, efficient soarer in which drag has been nearly eliminated. In a glide, its sink rate is nearly flat; under power, it climbs fast to high altitudes where the biggest thermals exist. This compact, electric-boosted sailplane is a soaring contest contender!

For more information, contact Hobby Lobby, 5614 Franklin Pike Circle, Brentwood, TN 37027.



W.R. BROWN Mini-Blast Booth

As a logical accessory to the Mini-Blaster, an economical sand blaster designed for use with all types of models and other small parts, W.R. Brown has developed a booth that contains the airborne abrasive and collects it for reuse. Of sturdy corrugated construction, the Mini-Blast Booth is easily set up for use or collapsed for storage. It features a large, plastic window that allows sufficient light by which to work and full visibility of the interior. Elasticized Tyvek sleeves permit comfortable access to the work area, while containing the grit generated by the blasting process. This unit is manufactured and sold as a blasting accessory only, and isn't intended for use for painting.

For more information, contact W.R. Brown, Inc., 2701 North Normandy Ave., Chicago, IL 60635.

JET MODEL PRODUCTS
Quiet Pipe

Designed and developed specifically for ducted-fan applications, the JMP Quiet Pipe provides a significant decrease in perceived noise, along with a measured drop in decibel value. This aluminum pipe is lightweight and comes with a pre-installed tank pressure fitting located to optimize efficiency. All seams are welded, and it's designed for use with .65 to .91 engines.

For more information, contact Jet Model Products, 304 Silvertop, Raymore, MO 64083.

F&E
New Catalogue

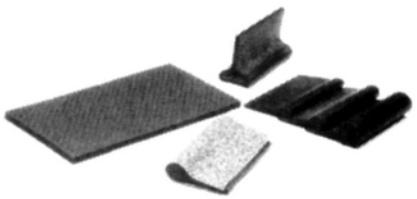
Farnsworth & Elroy, Inc., a manufacturer of fiberglass-and-foam radio-controlled model airplane kits, has announced the publication of its 1989 catalogue. The 16-page booklet covers the entire F&E line, including modern fighter aircraft, pattern planes, a basic R/C trainer and classic WW II warbirds. It also contains a complete line of replacement wing and stabilizer assemblies.

For more information, contact Farnsworth & Elroy, Inc., 1836 Stout Dr., Unit 1, Warminster, PA 18974-0206.

UNION
ARF Electric Planes

United Model now offers three ARF electric-powered aircraft. Each model is of foam construction for easy assembly, reduced building time, light weight and durability. All the models include a special BEC auto cut-off unit that allows the radio and motor to run off the same battery (as R/C cars do). When the voltage in the pack drops to a certain value, this BEC auto cut-off unit switches the motor off and then provides only the radio with power, so that the plane can be guided to a safe landing after a short glide. Each kit includes a 6V battery pack and quick-charger, so all you need is a radio system and about two hours of time to complete it. Union Model has really done its homework to create a complete package concept for modelers interested in electric flight, and for the newcomer who would like to give R/C flying a try.

For more information, contact United Model Distributors, Inc., 301 Holbrook Dr., Wheeling, IL 60090.



PERFECT PANEL
Contour Sanders

These innovative accessories make it easy to sand curves, corners, uneven surfaces and hard-to-reach spots. Just wrap sandpaper around any one of the five grips or the hand sanding pad. These grips sand concave curves with greater uniformity than can be accomplished by hand. The flexible sanding pad accommodates virtually any curve. The grips and the pad are made from flexible rubber. The set includes contoured grips in 5/8-, 1/2-, 3/8- and 1/4-inch sizes, one flat grip and one sanding pad.

For more information, contact Perfect Panel Products, 2246 Montrose Ave., Montrose, CA 91020.

X-ACTO
Blade Disposal

There's good news for hobby knife users. No more wrapping up used blades and tucking them into wastebaskets to avoid accidents. X-Acto's new product, X-IT, solves the problem of blade disposal. The X-shaped, durable plastic container holds used X-Acto blades of all shapes and sizes. X-IT is a convenient size (3x3x3 3/4 inches) for art boards and desktops, yet it's ample enough to hold a large quantity of used blades. Deposit blades into the slit, and when the unit is full, discard it and replace it with another. X-IT has an attractive contemporary design and a black, matte finish.

For more information, contact Hunt Manufacturing Co., 230 S. Broad St., Philadelphia, PA 19102.

Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News,** or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News.**

SPORT HAWK

(Continued from page 108)

increased elevator rigidity, I ran 1/16-inch music wire through the inner plastic tubes.

Slip the fiberglass exhaust tube into the fuselage, and assemble the motor-mount parts and glue them into place in the fuselage. Installing the molded-fiberglass intake duct is one of the most critical steps and, for me, it was the most problematical. I can appreciate the effort that must have gone into its engineering and manufacturing to make it fit as well as it does, but final installation is still a cut-and-try process. Since the duct is quite flexible before being glued into position, I was fooled into thinking that the alignment was perfect. Wrong! After it had been solidly epoxied in, I couldn't pull the rear opening tightly enough around the Dynamax unit, so I sliced the duct in a couple of places and tucked it in a little. I also needed some epoxy, cloth and micro-balloon filler to repair the duct. Although the fuel tanks seemed to fit well while the duct was loose, I had to cut it again later to get them back in.

The problem is that the front of the duct splits into two openings that spread apart as you pull the rear opening tighter. So the top priority should be to trim the back for a tight fit around the Dynamax, and then to trim the front of the duct until it fits into the fuselage. The front of the duct should reach the lip of the fuselage air inlets without interference. In any case, a considerable amount of epoxy and many micro-balloons are still required to blend the contour of the duct to the inlet lip. Although it wasn't mentioned in the instructions, Bruce suggested that I sand the inlet lip to achieve a 1/8-inch minimum radius.

Installing the nose gear, radio, canopy and engine hatch comes next. I used

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SPORT HAWK

(Continued from page 118)

Spring Air retracts and those neat little Sonic-Tronics* hinges for the nose-gear doors. All the Futaba* S-131 servos mount on a removable tray, which is a nice feature. I even had plenty of room for the retract valve and an extra mixture-control servo. The two elevator pushrods are actuated by one servo, using an ingenious mixer made from three steering arms on a torque rod. Both the canopy and the hatch openings are framed with the crescent-shaped bulkheads and 1/16-inch ply strips on the sides. Two similar bulkheads frame the hatch cover and provide the needed rigidity to mate well with the fuselage.

Finishing: When all the construction and component installation have been completed, it's time for finishing. I covered all the balsa surfaces with 3/4-ounce glass-cloth, which was applied with Loctite epoxy finishing resin. This was sanded, re-coated and sanded again—one of the easiest ways to obtain a smooth and durable surface on a painted model. The fuselage was given an application of Bob Violett Models' pinhole filler, with a second application over stubborn areas. It filled spots that were considerably larger than pinholes, and it really stayed put when completely dry. The whole airframe was then sprayed with two coats of HobbyPoxy gray undercoat and sanded after each coat.

When mixing the paint, I attempted to approximate my color documentation by using HobbyPoxy's custom military formulas. Fortunately, I was able to take my magazine photos over to the HobbyPoxy booth at the WRAM show and pull the color chips off Ken Williams's display until I found a good match. I selected

(Continued on page 127)

SPORT HAWK

(Continued from page 120)

British Ocean Gray and Dark Green. After the base colors and various squadron markings had been completed and the panel lines drawn, I applied a final coat of flat clear. The canopy was sprayed gloss blue with black and white highlights.

PERFORMANCE: This model delivers all the jet performance that you could want. The Sport Hawk is fast on the ground and *really* fast in the air. Acceleration on a paved surface is rapid, and takeoff occurs after about 150 feet of runway. In the air, the acceleration from partial to full throttle is smooth and quick.

At a high-speed cruise, the Sport Hawk feels very stable, groovy and responsive to the controls. Low passes with steep pull-ups are easy to accomplish and thrilling to watch. The model can be hauled around using lots of aileron and elevator control. In the turns, there's hardly any loss of speed and no sign of instability.

I've also found that the model is perfectly controllable down to really low air speeds, and the wing's washout seems to give excellent protection from low-speed tip stalls, even on landing approaches. A rookie jet pilot might be unprepared for the sink rate if the engine quits. At 40 or so ounces per square foot of wing loading, the model needs plenty of air speed to keep flying, and trying to stretch the glide can be disastrous. Unless you have lots of altitude to work with, you must keep the nose down to maintain speed and land straight ahead. On a routine landing approach, however, the Sport Hawk should keep going a long way with the engine running.

As a model for the experienced jet builder and flier, the Sport Hawk is unquestionably a good choice. The kit's only real shortcoming is that the instructions are too brief in some important areas. Perhaps only a first-time jet builder would be affected by this, and an evening phone call to Century Jet Models should clear up any confusion. The issue of high wing loading is common to most jets and scale models, so it's a concern mostly for someone whose experience is limited to sport airplane designs. I thought that I was well prepared, but I was still taken by surprise on a couple of dead-stick landings (that's how I broke the wing at the New England Fan Fly). I've also had trouble getting the engine to run reliably, but that's another issue altogether.

The Sport Hawk's flight characteristics are splendid. It isn't the fastest jet around, but it's right up there near the leaders. Best of all, its maneuverability makes it a lot more fun to fly than a guided missile.

**Here are the addresses of the companies mentioned in this article:*

Century Jet Models, *P.O. Box 111, Rantoul, IL 61866.*

Jet Model Products, *304 Silvertop Lane, Raymore, MO 64083.*

Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*

Bob Violett Models, *1373 Citrus Rd., Winter Spring, FL 32708.*

See Temp, *P.O. Box 105, Sussex, WI 53089.*

Loctite, *18731 Cranwood Park, Cleveland, OH 44128.*

HobbyPoxy Products, *36 Pine St., Rockaway, NJ 07866.*

Sonic-Tronics, *7865 Mill Rd., Elkins Park, PA 19117.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.* ■

SCHLUTER JR.

(Continued from page 87)

was correct. A few calls to other Junior owners solved the mystery: If the rotor speed is below an estimated 1900rpm, they all experience the same shake; loose or tight blade-mount bolts don't change a thing. No one has a solid explanation of the problem, and I think the Mini-Boy exhibited similar habits. Lifting off with a slightly rich 2-stroke will also produce the shake, but it immediately smooths when the engine clears into full 2-stroke. I think that the short blade span on the Junior requires high centrifugal force to keep the blades in a matched lead/lag position. Just as we used to do on Mini-Boys, a tailboom support could be added to tie the boom more rigidly to the mainframe.

The collective range on this bird allows it to be set up so that inverted flight doesn't differ a twitch from upright flight. Autorotations (maneuvers I practice when I'm ready to rebuild a machine!) are best left to those who thrive on them. Weighted blades are a must to retain enough energy for an error margin. Autos with stock blades should be reserved for pilots with plenty of experience, or for all of us in a "have-to-land" emergency.

Flight time must be monitored closely, especially if you're used to larger machines. The Enya .50 performs flawlessly, but it obviously consumes fuel at a faster rate than a .40 or .45, so flight times are limited to 8 or 9 minutes. A .40 or .45 engine would provide more than adequate power for the Junior, and it could extend flight time by about 5 minutes. If your flying style is of the "hot-dog" variety, a shorter flight time will reduce stress on you and the machine!

Typical of Schluter models, the Junior 50 offers a wide range of flight attributes. Beginners will find it a friendly, durable machine that will endure moderate mis-

(Continued on page 132)

Classified

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

SCALE DOCUMENTATION: Plan Enlarging. Photo packs, 3-view drawings for 1,600 aircraft. Super-scale R/C plans for Giant, Sport. 80-page catalog $4. Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239.

PLANS ENLARGED, Large Scale Specialists. PC Model Software. Free information. Concept, P.O. Box 669E, Poway, CA 92064; (619) 486-2464.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

GIANT SCALE PLANS by Hostetler. We fly what we draw. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

STRIPPED GLOW PLUG THREADS REPAIRED with stainless steel Heli-coils. 2-stroke heads $7.50. 4-stroke $10, postpaid. Send head only. Lee Custom Engines, 10112 Woodward Ave., Sunland, CA 91040.

MAKE A BEERCAN BIPLANE, 9 inches with 14-inch wingspan, $9.95. Kit Three, Box 72104, Marietta, GA 30007.

ENGINES: IGNITION, GLOW, Collectors, runners, used, new. Sell, trade, buy. Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537.

OLD TIMERS, take a ride back in time to airplane modeling roots with this vintage book—*Gas Models*. A true collector's book from the early editors of *Model Airplane News*. It contains the best of modeling from the '30s and '40s, including great technical information and classic construction articles from the Golden Age period. $7.95, add $1.75 S&H; Foreign Surface Mail, add $2.75; Foreign Airmail, $5.50; Payment must be made in U.S. funds drawn on a U.S. bank or by an International Money Order. Air Age Mail-Order Service, 251 Danbury Rd., Wilton, CT 06897.

NOW, OAK FLIGHT BOXES! Last a lifetime. New designs for easy handling. Extra convenience. Kits or finished. Free radio flyer decal, catalog. Write: S & D Model Products, P.O. Box 4026R, Des Plaines, IL 60016.

ANTIQUE IGNITION AND GLOW PARTS CATALOG: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

WANTED: RTF U/C planes and U/C race cars, mite cars; complete or pieces, with or without engines. Buy or trade. John Fietze, Box 1521, Amagansett, NY 11930.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

RAZOR BLADES, single edge, carbon steel, first quality industrial. $5 per hundred plus 10% shipping. COBBIE'S GIFTS, RR 2, Box 454-A, Staunton, VA 24401, (703) 885-8036.

CUSTOM EMBROIDERED PATCHES. Your design made any size, shape, colors. Five patch minimum. Free random sample and brochure. Hein Specialities, 7960 S.W. Manitou Trail, Glen Arbor, MI 49636.

FOR SALE: 1910-1960 model magazines, pulps, juvenile aviation books, historical aviation albums. $1 list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3

R/C WORLD—ORLANDO, FL, CONDO RENTALS—2 bedroom-furnished. Available weekly or monthly. Low rates. 100 acre flying field with enclosed hangar. Swimming pool, tennis courts on site. Minutes from Disney World and Epcot Center. For information call Kyra, (800) 243-6685 or write to Air Age Inc., Condo Dept., 251 Danbury Rd., Wilton, CT 06897.

SCALE MODEL RESEARCH Aircraft Documentation. World's largest. Over 2,500 different Foto-Paaks and 5,000+ drawings. Catalog $3. 2334 Ticonderoga, Costa Mesa, CA 92626 (714) 979-8058.

TEST FLIGHT VIDEO OF WARBIRDS all aluminum P-51D Mustang $25. Complete kit $5000 (less engine & radio). Warbirds Aviation, 122 Naubuc Ave., Glastonbury, CT 06033 (203) 657-3595.

HELICOPTER SCHOOL, 5 days and nights, all equipment supplied. Plus room and board on a 67-acre airport with lodge, used exclusively for R/C Training. Opening January, 1990 in North Central Florida. Owned and operated by Ernie Huber, 5-time National Helicopter Champion and Helicopter Designer. Plan your winter or spring vacation NOW! Send $2 for complete information package to: R/C Flight Training Center, P.O. Box 727, Cresent City, FL 32112-727.

R.C. AIRCRAFT LOG BOOKS—HIGH QUALITY! Designed to keep you flying, and your equipment in airworthy condition. For gas airplanes, gliders, and helicopters. No more guessing! Keep accurate airframe, engine, flight pack, and flight-time logs. Everything is covered. You will also receive a complete preflight and post flight check list. To order, send $6.95 to Lee Publishing, Dept. 207, Building 2, Suite 12, Box 877227, Wasilla, AK 99687.

WANTED: Old unbuilt plastic model kits. Planes, military, figures, cars, promos. Aircraft or missile desk models. Send list, price. Models, Box 863, Wyandotte, MI 48192.

WANTED: Your plan or kit for *Flying Model Warplanes: An International Guide*. Companies and individuals encouraged to register. Send Catalog to John Fredriksen, 69 Flamingo, Warwick, RI 02886.

PRIVATE COLLECTION: Hundreds of aviation magazines for sale: *Popular Aviation; Flying; Model Airplane News; Air Trails; RAF Flying Review; Wings*, and many others (1932-1960). All in excellent condition. For list, send $2 to William C. Fort, Jr., 4161 Robin Hood Rd., Jacksonville, FL 32210.

TURBOJET ENGINES for R/C Model Aircraft, Jet101, JetFan, Pegasus VTOL, F101 with afterburner. Most sophisticated Model Turbojet Engines in the world. Replaces Duct Fan Units. Complete catalog $5. JMW, Dept. 2, Box 60099, Pasadena, CA 91106.

AMERICAN RC COMMANDER w/autorotation, HB61PDP, Futaba FP-4FN w/S16's. All original, never assembled. $250 (218) 525-2297 eves, Duluth, MN.

WANTED TO BUY: Flying saucer and UFO plans and/or kits. Gas-powered or electric or rubber-band powered. Will buy complete assembled flying models. Klark Kent, P.O. Box 392, Dayton, OH 45409 (513) 298-7116.

STEALTH B-2 BOMBER. Set of 3 color photos, only $12. Send check to: Donald Holland, 3355 Wilshire Blvd., #904, Los Angeles, CA 90010. CA res. add 6% tax.

FLYING ACES MAGAZINES wanted. Most issues prior to 1943. Stuart Duncan, 3901 Linda Ln., Annandale, VA 22003.

WANTED: Offer $15 per kit for Xerox copies of printwood patterns and insignia sheet from 1/2-inch scale peerless model kits of P6E and F4B4. George S. Talas, 3835 Covington Rd., South Euclid, OH 44121.

MONOCOUPE. Rearwin. Culver, Gee Bee, Hall, Chester, etc. Catalog/news $3. Refundable. "Meticulous PLANS" by Vern Clements, 308 Palo Alto, Caldwell, ID 83605.

Send ad and payment to *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. **Non-Commercial classified ads** (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each. **Commercial classified ads** (rate applies to anyone selling on a commercial basis–retailers, manufacturers, etc.) Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number. **Closing Date** for either type of ad is the 20th of the third preceding month (for example, January 20th for the April issue.) We do not furnish box numbers. If you would like your ad run in more than one issue, multiply amount of payment by number of months that ad is to run. It is not our policy to send sample copies of tear sheets.

SCHLUTER JR.

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handling. Intermediate fliers will find all the challenges they want, and "hot dogs" will have a permanent grins when they find there isn't much this machine won't do.

I like the Junior 50. It's easy to transport, and maintenance requirements are about average. The .50-size engine helps the fuel budget while producing abundant power. The machine can be flown smoothly and gracefully from hover through competition maneuvers. It can also raise the "pucker factor" if turned loose, and it can perform well beyond most pilots' capabilities. Dieter Schluter has again given us a well-designed helicopter that can be flown successfully by diverse modelers.

**Here are the addresses of the companies mentioned in this article:*

Robbe Model Sport, *180 Township Line Road, Belle Mead, NJ 08502.*

Enya Model Engines, *Altech Marketing, P.O. Box 286, Fords, NJ 08863.*

McDaniel R/C Inc., *12206 Guinevere Road, Glen Dale, MD 20769.*

Futaba Corporation of America, *4 Studebaker, Irvine, CA 92718.*

GMP, *23961 Craftsman Rd., Calabasas, CA 91302.* ■

NAME THE PLANE CONTEST

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to **Model Airplane News**, Name the Plane Contest (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

CONGRATULATIONS TO MIKE DEGTOFF of Jacksonville, AL, for correctly identifying the French NORD 2501 Noratlas shown in our October issue. Mike's name was drawn from the 46 correct answers received—just when we *thought* we were making things a little tougher for you! OK; relaxation time is over!

A lot of you incorrectly identified our "mystery" airplane as a Fairchild C-119, but this wasn't surprising because it had the same twin-engine, twin-boom configuration. You don't suppose design engineers were commuting between Hagerstown, MD, and Paris at about the time this airplane was introduced, do you?

The Noratlas was developed as a cargo and passenger aircraft for the French Air Force, although a number have found their way into the civilian registry as well. It's still on active duty in various countries, including Germany, where it was manufactured under a licensing agreement established in 1956. Throughout its life, the basic airframe has seen a variety of engine installations, from the license-built Bristol Hercules of the original production lot to the P&W R-2800s of the 2508 variant. Wing-tip-mounted Turbomeca Marbore turbojet engines added some speed and takeoff power margins to the 2502 version. The 2501 had a crew of three and a 106-foot wingspan, and it could haul a useful load of 18,500 pounds while cruising at around 200mph. ■

The name of the winner will be drawn four weeks following publication from correct answers received on a postcard delivered by U.S. Mail and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year subscription extension.

HELI NATS

(Continued from page 93)

old Dwight Larks of Livingston, CA, will definitely soon be a great chopper pilot.

Intermediate Class was won by John Thomas of Augusta, GA, who caught and passed Maui Chai of Orem, UT, in the last round. These two swapped 1st place from one round to the next. Third place was nailed down by Steve Rhodes of Texas City, TX. I didn't have a chance to find out about each flier's equipment, but I did see a little of everything and saw that most of the helicopters were GMP Legends, Cobras, or Competitors, or Miniature Aircraft X-Cells.

FAI helicopter is the class that's flown in international competitions, and it requires both tough, precision hovering and high-performance aerobatics. Curtis Youngblood literally took off from the first round and never looked back; he told me that he was practicing for the World Championships, which were then only six weeks away (he was looking to hang on to his World Champ title). The other U.S. team members who flew at the Nats were Robert Gorham (Thousand Oaks, CA) who finished 3rd and Tim Schoonard (Orlando, FL) in 4th place. Second-place honors went to Mike Mas of Plantation, FL. These guys are really exciting to watch because of the type of flying required, and the overall spread of 72 points from 1st place through 8th shows how highly competitive this class has become.

Scale was dominated by Silas Kwok of Belmont, CA, who flew his gorgeous Jet Ranger. Timothy Garton of Edmonds, WA, flew his Bell Iroquois (Huey) to 2nd place when, for a few moments, he took us all back in time to the '60s skies over Vietnam. In 3rd place was Vince Canzanese of Skillman, NJ, who flew his very beautiful and colorful Bolkow BK-117. Vince really made the Bolkow perform like a full-size hot-rod. Even though Scale entrants were few, these three machines are typical of the best scale models in the country, and they have many details that the average modeler would omit.

The Nats is a really good place to see a group of varied fliers from all over the country; it's also a great opportunity to see the best show off their stuff. Maybe we'll see *you* there next year? ■

HELI CHALLENGE

(Continued from page 97)

ments like thousandths of an inch. Your job is to get the clutch starter shaft to turn with the engine so that at no point along its length is there more than two thousandths of an inch run-out (more accurately described as "wobble").

The job can be accomplished without the dial indicator, but not really to the degree of accuracy demanded by the task. So, off to the nearest dial-indicator store! What do you think one of these little critters might set you back once you've been lucky enough to find one? (not that many people even know what a dial indicator is, and you won't find one at just any hardware store). Around $100, once you've bought the stand and devices that allow you to contort this new marvel of precision into position so that it can do its job. You see, you can't just hold the dial indicator up to the shaft; you must hold it perfectly still so that it can't move at all.

Buying and installing the measuring device is relatively easy compared to the alignment process. With the dial indicator, fifteen thousandths of an inch looks like 1/2 inch on the dial face, yet you can barely see that much movement. To prepare myself for an entertaining evening of shaft alignment, I make sure I have a 12-pack and an open attitude!

Start by checking the shaft, right at the

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READERS' REPORTS!

We'd like you to participate in our "Readers' Reports" program, which was established to give you an opportunity to voice your opinion on products you've used. The guidelines are easy: Just send us a brief 3 or 4 paragraphs and a picture or two of any kit you've built or have underway. Tell us what you thought. If we use your report with one of our regular "Field and Bench" reviews of the same product, we'll award you a complimentary subscription to *MAN*. It's that easy. Participate! Make your views known.

Some of the kits now being reviewed:

Ace All Star Bipe
Parkinson Regal Eagle
Global EZ Dago Red
Yellow Aircraft CAP-10
GMP Rebel
Miniature X-Cell 30
D&R P-51
Parma Aerosprint
Top Flite Elder Bipe
Midwest Aero Sport 40
Midwest Hots II
Sig Four-Star 40
O.S. Ryan
Global EZ F-16
Kyosho Electric Mustang
Dynaflite 40 Mustang
Bonded Roun-Tuit
Bob Violett Models F-86
EZ P-51 Dallas Doll
CGM Freedom 20
R/C Design Weasel
Parma Aero Tiger
Midwest Electric Hots
Duracraft Durabat

HELI CHALLENGE

(Continued from page 133)

bottom, just above the clutch, and if there seems to be a lot of run-out, try removing the clutch bolts and swapping bolt-hole locations on the fan face. Re-check the shaft run-out at the bottom, and see if it's closer than at the first attempt. Loosen the clutch bolts slightly so that the clutch can be tapped, shifting the clutch under the slight pressure of the clutch bolts. Continue to turn the engine over while checking the run-out until you get the bottom of the shaft to within .002 inch. When you've done this, tighten down the clutch bolts (apply thread-locking compound to the bolts before tightening them). Some modelers neglect to set this part correctly, and they never know why they're having vibration problems. Shaft wobble this low on the shaft is extremely hard on engine bearings and clutch parts, so take your time; even if it takes several tries, *get it right*.

Now check the run-out at the middle of the shaft; once again, the tolerance is .002 inch, or less. The trick here is getting the shaft run-out set in the middle without affecting the bottom. Usually, as the center of the shaft is tweaked into alignment, the bottom will remain aligned as long as it's rotating exactly in the center of the engine's axis of rotation. If it isn't, repeat the first step, and then move to the second step and repeat it until both measurements are within the prescribed tolerance.

Next, check the run-out at the top of the shaft. I use a long nut driver, which has a hole bored in its center and will slide down over the top of the shaft to about 1 inch from the top. The nut driver helps to prevent the shaft from bowing, which would necessitate attempting magic when trying to eliminate center-shaft run-out.

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CLUB OF THE MONTH

Long Island Radio Control Society

JUST ABOUT half an hour by road and a one-hour ferry ride across Long Island Sound from *MAN's* Connecticut office, you'll find the picture-book-pretty town of Port Jefferson, NY—but that *isn't* why we've chosen this club as our "Club of the Month" for December, '89!

This club boasts many OT fliers, and SAM rule changes are featured on the first page of its August/September newsletter. Under discussion is a rule to ban diesels from antique events, but newsletter Editor, Neil D. Markee thinks that one group of losing SAM competitors is merely trying to ban the engines the winners have been using. He suggests that, after this, the "baddies" who have been using "the unfair kerosene burners will probably retaliate by raising the minimum weight to penalize those who win by building to the minimum weight. And then..."! Do you get the picture?!

The group held an Old-Timer Invitational Fun Fly in early October, suspending the club muffler rule for that day, but insisting on the Limited Engine Run (LER) rules to restrict noise. They hoped to attract OT enthusiasts who weren't club members (and perhaps attract a few new members that way?), and asked members to invite OT newcomers. In an earlier OT event, the winner was a Cleveland Cloudster, while a Buzzard Bombshell buzzed into second.

And gliders, too! Would you believe that for their July 23 contest they had a "perfect" day and that the field was in "perfect" condition? Add heat and "plenty of thermals" to this and you can picture some glorious soaring. Larry Davidson came all the way back from Canada just to CD the contest and beat the natives—a feat that he apparently performs with unfailing and monotonous regularity! Great case for not allowing CD's to participate!

Just for living in Port Jeff and being on our editor's route between his home and our offices (not really—honest!), we're pleased to ferry this club two free one-year subscriptions to the world's greatest R/C model plane magazine, and we wish them continued success with their very many varied activities. ■

HELI CHALLENGE

(Continued from page 134)

You'll have to experiment with how much pressure to use when aligning the shaft. Try to be patient! Sometimes, everything just falls together; at other times, you really have to struggle. If you get really frustrated, drop me line, and I'll enter you in the Start-Shaft Aligners Anonymous Association (I'm a charter member). When you've filled out the postcard, you'll have a fresh perspective and will be ready to get back to the shaft.

I recently spent three evenings doing this for one helicopter, and I fail to understand why kit manufacturers don't find a better way to do this. You could knock the shaft out of alignment with the starter motor, or even on a hard landing. My first helicopters had belt starters, and I never had a problem installing the engines or getting rid of vibrations. The dial indicator is a convenient accessory if you're aiming for perfection, but it's too much for average tool collections. In closing, I make a plea to kit manufacturers: Find another way! ■

ADVERTISER INDEX